Electrical World

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Will the Merger Trend Continue?

NOTHING in the recent stock market upheaval warrants the expectation that mergers in the power industry will come to a dead stop on account of the conservatism of capital resulting from the almost unprecedented shrinkage in security prices experienced in the late crash on the exchanges. Here and there the opinion has been heard that the behavior of the market has for the time being put an end to serious efforts to combine properties or holding groups, but as a practical matter the conditions are in many ways more favorable to the creation of economically justified consolidations and control achievements than before the débâcle. Less total money is needed to attain majority control in many cases, and the economic pressure to establish the best possible operating and managerial relations among group members is no less than a few weeks ago, if indeed it is not greater.

So long as it can be demonstrated that service can be rendered at less total cost through merged utilities, the spur of necessity will drive this movement forward. On the other hand, the chances of successful mergers based on speculative possibilities only are at present dim and uncertain, and it is a good thing for the industry that this is so. Thorough and searching analyses of property operations in a group, rather than brokers' estimates of profits to be reaped through speculative deals, will establish the merger background for some months to come unless all signs fail.

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Power and Light Bond Record Spells Stability

TO HAVE built an eleven-billion-dollar industry in a little over a generation is an achievement. So to have shaped the capital structure of an industry of such rapid growth that its preferred-stock dividend record is almost perfect and default in its bonded indebtedness is negligible is a most unusual achievement.

This is the record of the power and light industry. Out of perhaps six billion dollars of bonded indebtedness, default in interest or principal on November 1 was, a recent investigation shows, less than four millions, or an insignificant fraction of one per cent; and much of this represented utility properties other than electric.

Such a record says more of inherent stability than volumes of involved argument. It makes 1930's financing program in a deflated market infinitely less of a problem than it might have been. It puts up a challenge to present-day power and light executives and their bankers to build equally well in the consolidation movement in process—a challenge they could not fail to accept even if there were any inclination to do so.

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An "All-American" Opportunity

IT IS evident that President Hoover is trying a new experiment in business. His conferences are an attempt to have industry undertake to maintain a stable and balanced condition through its own efforts at organization on a national scale. All this is at the "talk" stage at present, but it will be business itself that will be responsible for success or failure in carrying out the idea of the President.

The electrical industry has made adequate expression of its determination to carry on its own affairs in a sane and level-headed way. Both utilities and manufacturers have placed on record their intention to carry out their normal program of expansion. This is all that is expected. There is no desire to force business or to produce a business boom. But the practical success of the plan depends upon the degree to which each unit in the electrical industry carries out the pledge of the leaders. Each utility company and each manufacturer can do his part only by action. Buying should not be postponed, sales should not be curtailed, advertising should not be restricted. The word should not go forth to "postpone all possible expenditures and restrict all expansion plans."

The electrical industry knows from past experience that it has a very stable rate of growth and that valleys and peaks are of brief duration. It takes no chances whatever in building, buying, selling and expanding at a normal rate. That, let it be repeated, is all that is expected of it in its individual field as an industry. Beyond this, however, it is obligated to do its part in the co-operative plan for all industry. No group is more competent or has more at stake in the stabilization of all business. Beyond any doubt, the leaders of the electrical industry will seize the opportunity to perform a national business service that will reflect itself in

increased public confidence and a more stable business situation. It is a time for both "all-American" players and an "all-American" team.

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Better Factory Lighting for New England

CORDIAL acceptance by New England industrial leaders of the McGraw-Hill editors' suggestion regarding the need of better factory lighting in that territory is one of the first fruits of the recent trip of this group through the Northeast. The New England Council, under whose auspices the tour was planned and executed, reports a widespread and growing disposition on the part of manufacturing establishments to look into their lighting conditions, and the co-operation of the power companies is being utilized to give the right direction and impetus to this important movement for industrial betterment.

New England is, of course, far from unique in its opportunities for more effective factory illumination; but in a sense the matter was brought to a head by the report of this group of trained observers focusing attention upon the possibilities. There is no question that the manufacturing interests of that area are at present in a highly receptive mood toward improved lighting, and every electric service company in the region can blame only itself if it fails to capitalize the opportunity immediately at hand to aid its industrial customers to increase production, reduce eye strain among employees, enhance safety in plant operation and tone up the appearance of even the establishments which show the inevitable results of age.

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Will Changing Fuel Change the Engineering?

COAL is so generally recognized as our primary fuel that the use of any other is commonly regarded as being of rather limited interest. It may come as a surprise, therefore, that only 85 per cent of the fuel used in electric utility power plants in September was in the form of coal, 3,855,393 tons being burned. More than 10 per cent was natural gas, the remainder oil, aside from a small amount of wood burned in the lumber-producing states. These ratios are obtained by reckoning 4.3 barrels of oil and 23,000 cubic feet of natural gas as equivalent to a ton of coal, following the practice adopted by the Geological Survey.

Reports of the survey indicate that more than 10,600,000,000 cubic feet of gas was consumed in September in public utility plants—50 per cent more than was used a year ago. This is roughly equivalent to 460,000 tons of coal. Two Southwestern states, Texas and Louisiana, account for more than half of the total, with a considerable addition from Oklahoma. Of the remainder, the larger part is reported for California.

The marked increase in the consumption of liquid and gaseous fuel must to some extent influence the engineering of power plants in those regions in which it prevails. Meanwhile the recent deficiency of water power has brought the matter of steam capacity strongly to the front. As to the plants using gas, the increase has been so rapid that discussions of the engineering aspects of the question are still lacking. No doubt a new technique is being developed, of which we may expect to hear something when the engineers have had time to write it up.

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The Chamber Conference a Challenge to Electrical Men

LAST week in Washington, on the initiative of President Hoover, four hundred leaders of American business gathered at the call of the Chamber of Commerce of the United States. It was described as a "national business survey conference." It was probably the most distinguished gathering of executives of commerce and industry ever brought together in this country. Their purpose was to present and review the present status of the nation in its economic aspect. The very fact of their responding to such a call was an encouraging demonstration of the extent to which industry is becoming co-ordinated and co-operative through its increasing interdependence. The very character and responsibilities of these men made the event impressive and important.

Two conclusions out of the mass opinion stood forth clearly: First, there was a universal confidence in the soundness and stability of present business conditions and a belief that 1930 is to be a good year. Second, there was frank recognition that the discomfort caused by the recent attack of acute indigestion in the stock market can be relieved only through action which individual manufacturers and business men must take. In other words, the sweeping gesture of a conference, the marshaling of a committee or the recording of a resounding resolution in themselves accomplish nothing beyond the influence of leadership. If business needs to tighten its belt to offset the bad effect of the recent pain in Wall Street, it must be accomplished by reducing waste and promoting efficiency in the actual production, distribution and marketing of goods.

There is no other group of men more concerned in such a situation than those who operate the electrical industry—in terms of both responsibility and opportunity. For economies in factory production come not from pressure on men nor mere eager desire, but rather from those practical improvements in modernization, handling of materials and working conditions that management provides to speed the work, to reduce costs and to better quality. In such a process power application and control, illumination, ventilation and accident pre-

vention are prime factors. In a word, electric service offers methods of modernization that can contribute millions of dollars in added profits to American business by the simple expedient of saving money in factory operation.

It is a clean-cut challenge to the electrical industry. It is an answer to the issue which the conference has raised. There is no other single opportunity for such direct action. It would be a good thing for the organized electrical industry to come forward with a program.

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Stability Involves Cost and Service

POWER system instability is not one problem but many. To the engineers concerned with generation, transmission, substations, customer supply, it exhibits diverse faces, and to the executive it has an aspect different from all the rest. For each manifestation, that is, as a departmental problem affecting generation, transmission or some other operation it may have many solutions, and the solution chosen in a particular manifestation may have much or little effect in another. But any solution chosen for any aspect will have effect at the top of the organization according to its cost.

Ignoring expense, any power system can be made as stable as the Rock of Gibraltar. All that is necessary is to make every element in the system strong enough to withstand every shock. The trouble is, expense cannot be ignored. The factor of economy must enter every problem of power-system operation. This factor compels a reassignment of values to every other element in the equation if one side is to balance the other. The problem before the engineer is not simply to discover how stability may be achieved but how to attain it economically.

The factor of economy in stability calculation is a variable dependent on conditions of different systems. A system of large capacity can spend more money than a smaller one. A service standard that recognizes no inevitability of outages will require a much greater expenditure for stability than one that permits even a very small percentage of service failures.

These considerations make it extremely difficult, if not impossible, to talk about instability in general terms to apply to all technical phases of the subject, to all types of power systems and to all ideas of what constitutes an acceptable service standard. The most nearly successful endeavor to reduce the stability problem to a common denominator of understanding was made at a recent meeting of the Great Lakes Engineering Section of the National Electric Light Association. The various technical phases of the project were first discussed by experts in their line, and then the whole problem was summed up from the executive point of view.

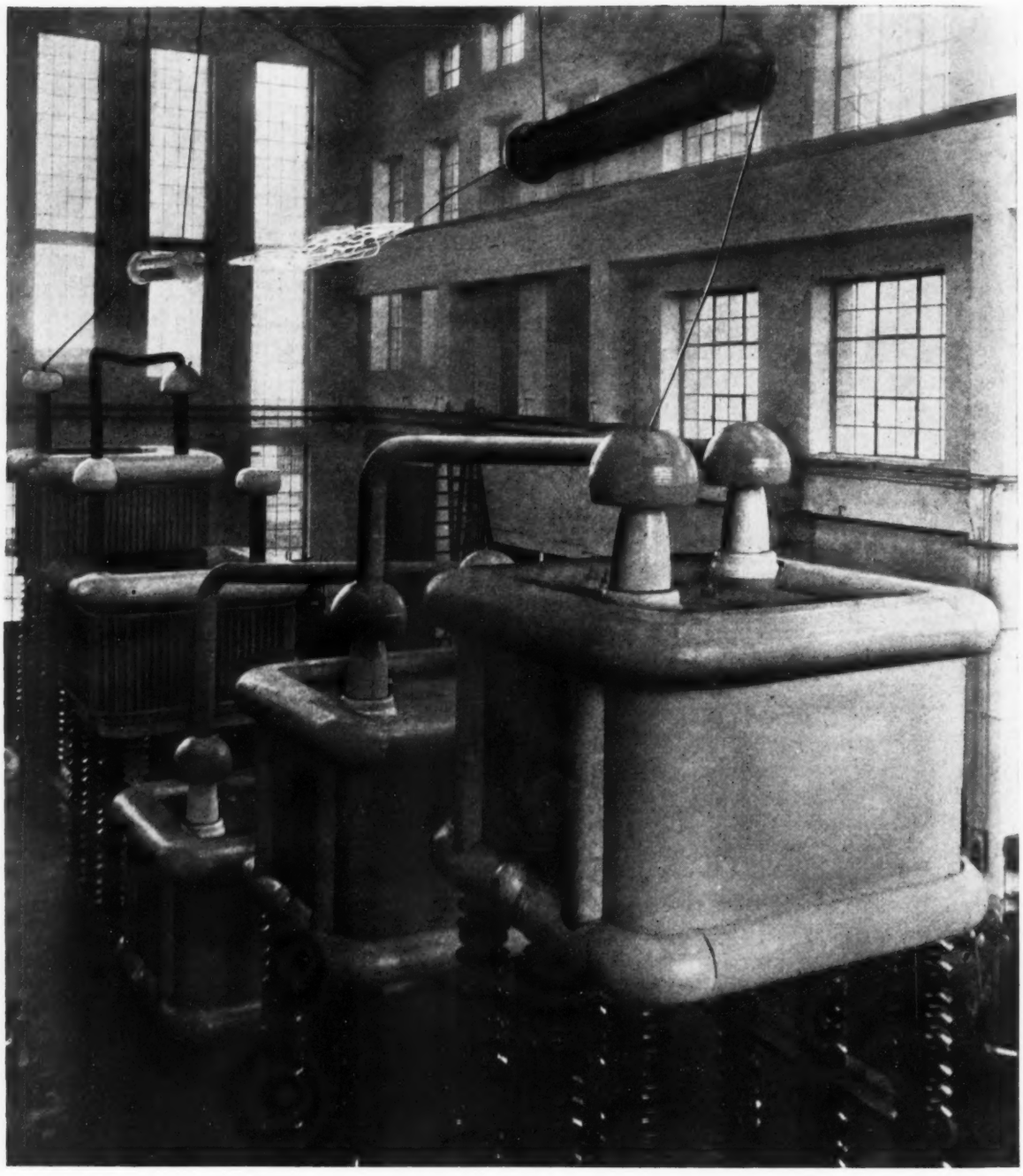
Boulder Canyon Dam and the Federal Water-Power Act

UNDER the Boulder Canyon project act the Secretary of the Interior is required to resolve conflicting applications for electric power with due regard to the public interest and in conformity with the policy of the federal water-power act. Mark, however, how some legislators and municipal ownership advocates interpret the act. At a recent hearing in Washington on Boulder Dam power allocation held by the Secretary of the Interior, Senator Pittman of Nevada and W. B. Mathews, an attorney representing the Department of Power and Water of the city of Los Angeles, contended that under the act there is no standing for the privately owned power companies, nor should they have participation in the operation of the plant. Moreover, the city of Los Angeles and other municipalities seek all the power allotted to California as well as that allotted to but not at present required by Nevada, besides water supply for themselves. The government was also asked to install all the power-generating equipment. Thus, aside from considerations of flood protection and irrigation, Los Angeles feels that the Boulder Canyon project will be built for its special benefit.

Of course, the Secretary of the Interior, although hailing from California, does not so interpret the act, and he has allocated 50 per cent of Boulder Dam power to the Metropolitan Water District of southern California, or so much thereof as may be needed and used for pumping Colorado River water; 25 per cent to the city of Los Angeles and 25 per cent to the Southern California Edison and associated companies, these allotments to be subject to certain deductions arising through the exercise of preference rights. It is well, however, to have this biased interpretation of the federal water-power act on record and to guard against its implications in other sections of the country.

Now, it is true that the federal water-power act gives preference to governments and subdivisions of governments, but only "provided the plans for the same are deemed by the commission equally well adapted, or shall within a reasonable time to be fixed by the commission be made equally well adapted, to conserve and utilize to the public interest the navigation and water resources of the region." The privately owned power company serving the Los Angeles district supplies four-fifths of the power in the territory, part of which is employed to pump water for all the crops of that section and the remainder for turning the wheels of three-fourths of the industry, and in addition supplies electric service to two million people living in southern California. Naturally, if the plans of the municipality of Los Angeles are equally well adapted to conserve and utilize in the public interest the power in question, it is entitled to a preference; but neither the Federal Power Commission nor the Secretary of the Interior has thought so.

Germany Tests at 2,000,000 Volts



WHAT is said to be the first 2,000,000-volt, 1,200-kva. test laboratory has been placed in operation at the transformer works of the Koch & Sterzel Gesellschaft at Mickten, Saxony. Five series-connected 400-kv. transformers are used. The discharge illustrated is for 2,000,000 volts over a 16-ft. gap.

Samuel Insull Asserts

"Business as Usual"

AS EVIDENCE that I and my associates do believe that business will be as usual in the coming year, I make known some of my own plans. In round numbers the companies with which we are identified have planned to spend $200,000,000 in 1930 for extensions and improvements. This will be "business as usual" for these concerns.

* * *

Compared with this and the previous year, in 1928 we spent from our construction budget $147,000,000 in round numbers; at the end of this year, 1929, we will have spent $162,000,000, or $15,000,000 more than we spent last year. By spending $200,000,000 next year, we will exceed this year's budget by $32,000,000. As our sphere increases, our investment expenditures must increase from year to year.

* * *

The point I wish to make is, not that the Commonwealth Edison Company has increased its budget, or that the Middle West or the Peoples Gas has done likewise, but that we are going ahead with our expansion and improvement program just as we had planned to do before the stock market took sick. We are sticking to "business as usual" because we believe the condition of the country warrants our doing so; because, as we see it, the prosperity of our business and the needs of the people we serve demand that we shall do so.

* * *

This construction program to which we are committed is not the result of anything which has happened in or to the stock market; it was not patched up hurriedly to enable us to make a gesture of confidence in our business and in our country; it is not announced as a mere contribution to a cheerful Christmas spirit.

* * *

Our expenditures must be planned one or two years, or even longer, ahead of the time the extensions and betterments they will pay for will come into use. The work we will do next year will be the logical consequence of the work we have done this year and last year, just as our construction program in 1931 will be the logical consequence of the work we have done this year and will do next year. We feel that we are in a continuing and a growing business; we feel that we are in a business where foresight and preparedness pay dividends—dividends not only in cash but in the value of our service, in the confidence of those who work for and with us and in the esteem of our public.

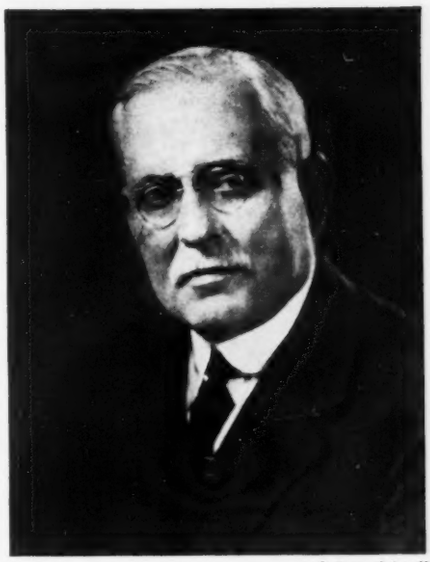
Hence I repeat, this expansion program of ours—a program which I hope will help to hearten those whose faith is wavering or whose footsteps falter, and will hasten the emergence of some of the weak-hearted from their cyclone cellars—is part of "business as usual" with us.

* * *

To know where we stand we have surveyed the general business conditions of the country to the best of our ability. We are convinced that the credit situation of the country is good; that collections are practically normal; that there is no extraordinary accumulation of inventories; that the market disturbance was not caused by a shortage of money; that money, in fact, is plentiful. We know that the success of our business depends upon the success of other businesses. We know that the extension of the use of our service depends upon the financial ability of the everyday householder to use and pay for that service.

* * *

The men at the top would inspire more confidence in themselves if they would shout in unison. Take Washington, for instance. Business will never get anywhere while our leaders are trying to promote prosperity at one end of Pennsylvania Avenue, when destructive criticism goes on at the other end.



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A Courageous Leader

Samuel Insull made the statements quoted on this page to the Economic Club of Chicago, December 3.

Distributed among companies of Insull identification, the next year's expenditures for extensions, betterments and the like will be about as follows:

Commonwealth Edison Company	$23,168,000
Peoples Gas Light & Coke Company	10,300,000
Public Service Company of Northern Illinois	30,867,540
Middle West Utilities Company, through its subsidiaries	71,107,651
Western United Company, on the Fox River	2,075,896
Chicago Aurora & Elgin	560,000
Chicago Rapid Transit	972,972
Chicago, North Shore & Milwaukee	750,000
State Line Generating Company	1,000,000
Midland Group, in Indiana	35,045,962
Super-Power Company of Illinois	21,407,460

Neither will there be established a sound basis of prosperity throughout the country by trying to give something more to the farmer which must be taken away from the manufacturer, or vice versa. To rob Peter to pay Paul will be no great help to the general purse.

* * *

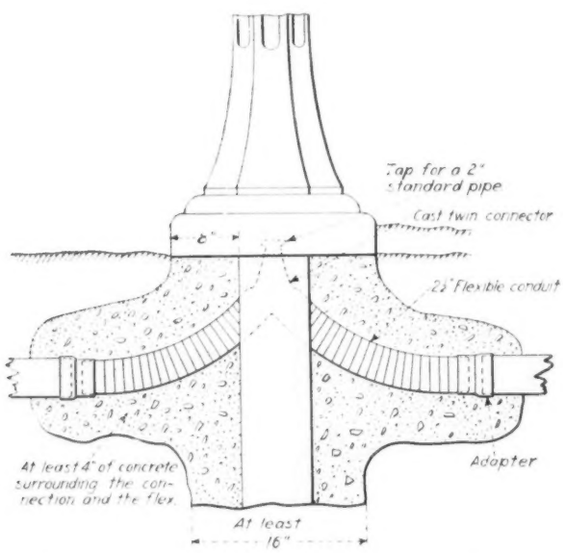
The fundamentals of American prosperity are in the possession of the American people. The stock market happenings of the past two months have not diminished the resources of the country by the value of a single dollar. All we need to do to achieve an enduring prosperity is to devote our energies toward the creation of wealth, rather than to the creation of prices.

* * *

The elements of prosperity remain, as always, work and thrift and prudence. With our natural resources we are neither compelled to work as hard nor to exercise the same degree of thrift to create wealth as other peoples, less happily circumstanced. We who live here are favorites of fortune. We ought to be ashamed of ourselves if we fall short of our opportunities. It will be our fault if we let the mean in spirit or the malignant in disposition either scare us or talk us out of our rightful heritage. That heritage is, as I see it, wealth and the comforts and advantages of wealth, together with protection from the ills of poverty, beyond the most ambitious dreams of any other nation upon this earth.

Street-Lighting Pole Without Handhole

FOR cases where accessible space need not be provided in the base of street-lighting posts for a series transformer the Rochester Gas & Electric Company has developed a standard without any handhole in the base.


Tap for a 2" standard pipe
Cast twin connector
2" Flexible conduit
Adapter
At least 4" of concrete surrounding the connection and the flex.
At least 16"

Flexible Conduit and Y Fitting Connect with Vertical Pipe Inside Post

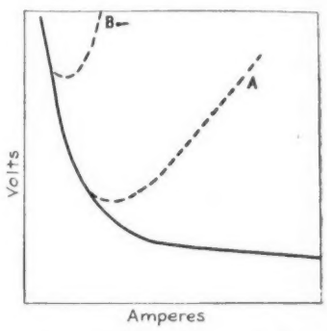
The conduit runs are connected through flexible tubing to a Y at the lower end of the vertical riser inside the concrete column. The leads to the lamp are pulled by hand from a ladder or tower through the top of the standard. The head is aluminum. The Y connection at the base of the pole eliminates, in many cases, the necessity of a pull box or handhole at the pole.

Theory of a New Valve Type Lightning Arrester

Discharges confined to the interstices of naturally porous material indicate possibilities for development

By J. Slepian, R. Tanberg and C. E. Krause*
Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

THE protective value of a valve type lightning arrester is determined by the ratio of the maximum voltage which may normally be impressed on the arrester to the cut-off voltage at which current ceases to flow through the device. A new method for obtaining a discharge which requires for its maintenance a voltage comparable to that required to initiate the discharge has been discovered. It has been found that the voltage required to maintain a discharge can be raised to high values by confining the discharge to narrow passages with insulating walls. This condition is shown by the accompanying graph in which are plotted the volt-ampere characteristics of discharge in the open and in holes of different sizes. These curves indicate that for discharges confined to holes at atmospheric pressure there is a minimum voltage which occurs at a relatively small current and that with smaller holes this minimum voltage is greater and occurs at smaller current. The condition evidently holds out definite possibilities of attaining relatively high cut-off voltages while the discharge current remains at comparatively small values.



Volt-Ampere Characteristics of Discharges in the Open and in Holes of Different Sizes

Experimental Tests Confirm Theoretical Analyses

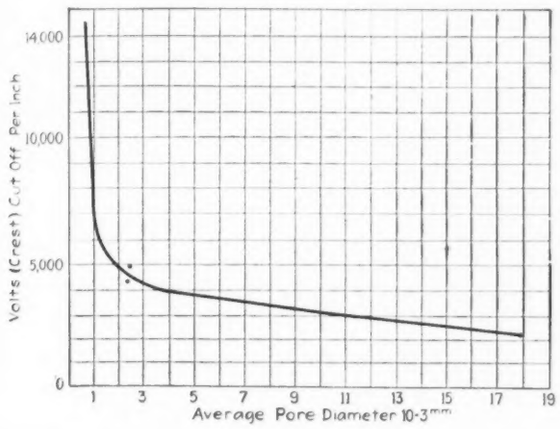
Extending this reasoning to discharges in the millions of fine holes in a naturally porous material, the conclusion was reached through experiment and analysis that discharges through these materials will have high cut-off voltage.

By combining the discharge following breakdown to very fine channels it is possible to raise greatly the minimum voltage for maintaining the discharge and thus greatly improve the valve effect. To obtain a voltage ratio sufficiently low to make a good valve type lightning arrester, however, calls for material with pores of an exceedingly great degree of fineness. The authors have found that by incorporating small amounts of conducting material, such as lamp black or powdered metal, in the porous material the break-down voltage is considerably reduced, while the cut-off voltage is unaffected. In this way it is possible greatly to improve the valve

**Presented at the Great Lakes district meeting of the A.I.E.E., Chicago, December 2-4, 1929.*

effect and to reduce the stringency of the requirement as to the fineness of the pores.

The way in which the finely divided conducting material causes break-down voltage to be lowered is readily pictured. The conducting particles are distributed through the porous material and are too few in number to form many conducting paths through the material. The few continuous chains of conducting particles through the material accounts for the conductivity at low voltage. Besides these continuous chains there will be some chains of conducting particles which are not completely continuous, but have tiny breaks in them. When the voltage impressed on the



Relation Between Cut-off Voltage and Average Pore Diameter

piece is raised to a few hundred volts those chains which have single tiny breaks will begin to carry current, a discharge occurring across the tiny break in each chain. The current in this discharge is kept small by the high resistance of the fine chain leading up to the break. As the voltage is further raised chains of conducting particles with two or more breaks begin to carry current. Thus the porous material becomes permeated with these tiny discharges across the minute breaks in the conducting chain. The current taken by a pore at the break-down voltage is lessened when the conducting material is added.

Hence with a multiplicity of holes in parallel for discharge of a given current more holes will participate. Thus the duty on each hole resulting from the mechanical stress due to the pressure developed by the discharge is lessened, since both the voltage and the current are lowered. This is a very important advantage obtained by the addition of the conducting material. The tendency to shatter or puncture observed in insulating porous material when subjected to very heavy discharges was almost completely eliminated by the addition of the proper amount of conducting material.

The amount of conducting material added must, of course, be properly chosen if desirable lightning arrester characteristics are to be obtained. If too little is used the break-down voltage will be high in comparison with the cut-off voltage and the material will also tend to shatter or puncture. If too much is used large leaking current will cause the cut-off to be vague and impose too great a duty on the series spark gap. In a later paper the authors hope to show how the possibilities held out by this investigation have been realized.

Correct Bonding Wires for Secondary Cables

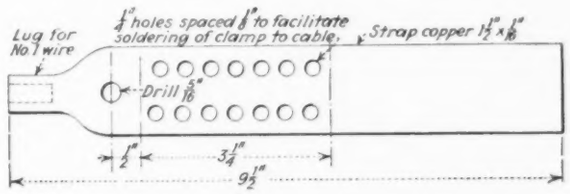
CARL W. EVANS
San Antonio Public Service Company, San Antonio, Tex.

THE function of bonding wires is to maintain the sheath of lead-covered cables at ground potential, or as near that as possible. If this function is to be adequately executed it is essential that bonding wires have the same current-carrying capacity as the cable sheath. This function is of much greater importance to the secondary cable of network systems than to others because of the practice of burning faults clear. With bonding wires of insufficient current-carrying capacity the appearance of a conductor to sheath fault may cause one or more bond wires to fuse, in which case the resistance of the fault would increase and the time required to burn clear might be extended or the fault might not burn clear at all and the heavy sheath current would tend to heat other sections of the cable.

The following table gives various standard-sized cables used in underground distribution systems and the corresponding copper wire sizes of current-carrying capacity equivalent to the lead sheaths of the cables.

Cable	Bonding Wire
250,000 circ.mil 3/cond. 4/64-in. x 3/64-in. insul. 8/64-in. lead	A.W.G. No. 1
1,000,000 circ.mil 1/cond. 7/64-in. insul. 7/64-in. lead	A.W.G. No. 3
500,000 circ.mil 1/cond. 7/64-in. insul. 6/64-in. lead	A.W.G. No. 4
250,000 circ.mil 1/cond. 7/64-in. insul. 5/64-in. lead	A.W.G. No. 6

The bonding of cables is further facilitated by the use of a standard bonding clamp as shown in the sketch. This clamp consists of a lug of proper size made an integral part of a copper ribbon $1\frac{1}{2}$ in. x $\frac{1}{16}$ in. One $\frac{5}{16}$-in. hole is punched near the lug for the bolt. The



Wrap Clamp for Bonding Cable Sheaths Is Flexible Device

other bolt hole required is punched at the proper place in the blank portion of the ribbon, at the time of installation.

There are many advantages in the use of such a device: It makes each cable bond a unit unaffected, except when the cable upon which it is installed is changed; the clamping feature aids in the obtaining of a low resistance contact, and the perforations make it easier to solder to the cable; the lug, which is an integral part of the clamp, lends simplicity to the problem of tying all bonds to a common grounded neutral, and one size may be carried for cables ranging from 250 circ.mil, one-conductor to 250 circ.mil, three-conductor.

High-Tension Metering

Features of equipment used on 220,000-volt lines for measurement of transfer power. Combination unit of current and potential transformer favored

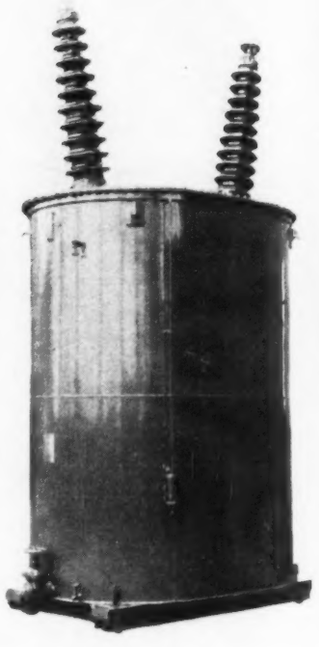
By H. M. SANDERS

Westinghouse Electric & Manufacturing Company, Sharon, Pa.

THE past decade has brought about great achievements in the development of power transmission lines and in the interconnection between large systems for the interchange of power at high potentials. As this transfer of power is a commercial proposition, the matter of accurate and reliable measurement is of even greater importance. This power must be recorded at current and potential values within the range of the instruments which meter the kilowatt-hours used by the smallest consumers of power.

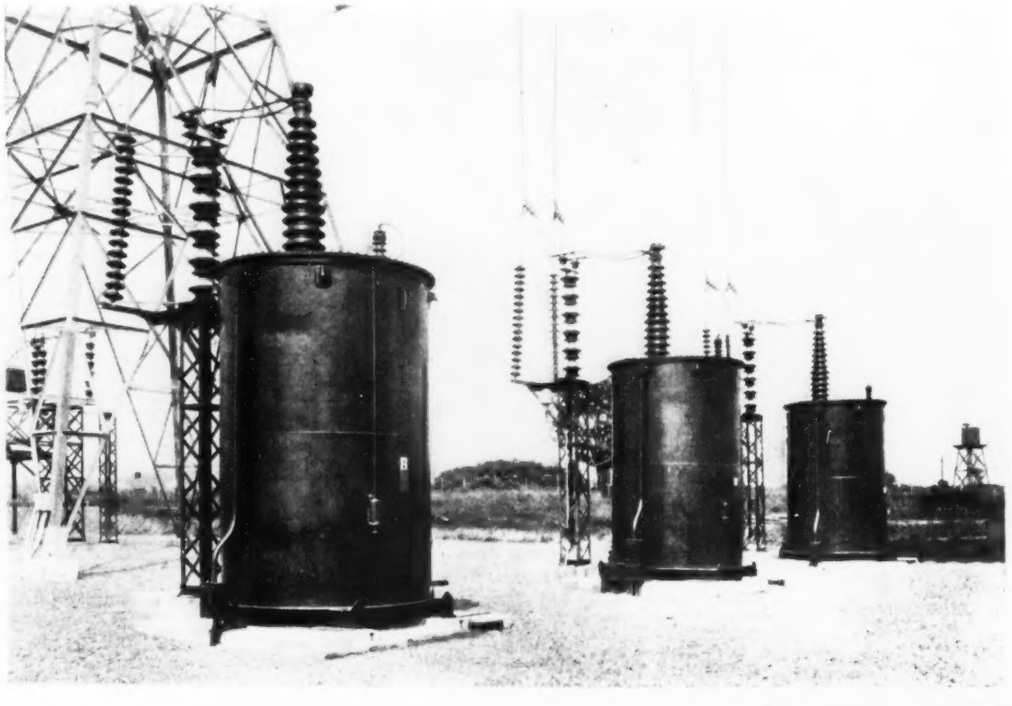
Although separate transformers are available in these high-voltage classes, considerable saving in weight and space is gained by making combinations of the current and potential transformer elements, mounting them in the same case and using common high-voltage outlets for both. This also means a material reduction in cost. Two examples of this type of metering equipment, designed and manufactured by the Westinghouse Electric & Manufacturing Company, are here described.

The first of these is an installation at Plymouth Meeting substation of the Philadelphia Electric Company on the 220-kv., 60-cycle, three-phase, grounded neutral transmission line. It has been in operation since early in 1928 and measures, at transmission line potential, the interchange of power between the Philadelphia Electric Company and a neighboring power company. The equipment consists of three units, each containing a single-phase current transformer in series with the line and a single-phase voltage transformer connected between line and ground. Graded insulation is used on the neutral end of the voltage transformer and this end is supplied with a reduced voltage outlet bushing.



High-Voltage Metering Transformer for Danville Installation

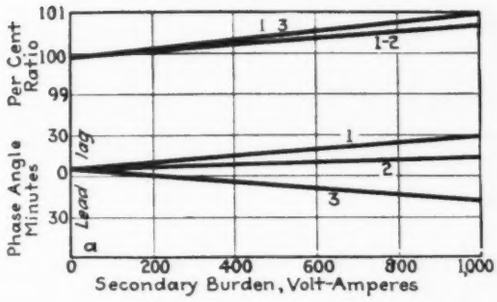
The potential transformers are 1,000 volt-ampere



Plymouth Meeting 220,000-Volt Metering Equipment Consists of Three Units, Each Containing a Current and Potential Transformer

Performance of Potential and Current Elements at Plymouth Meeting

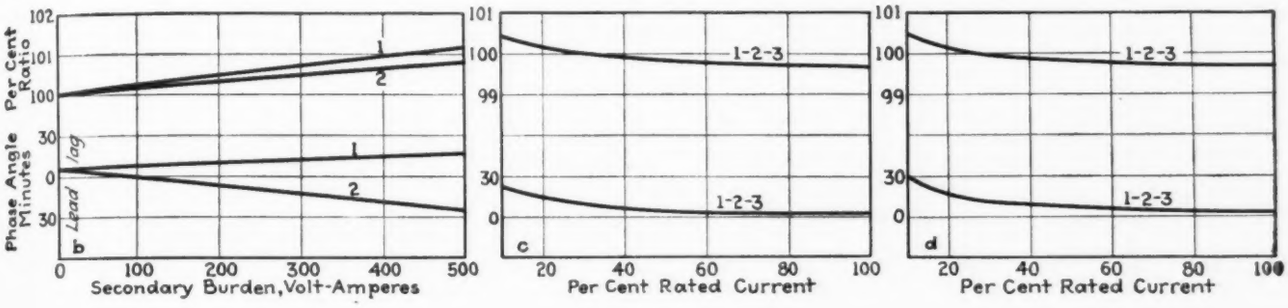
(a) 132,000 to 110 volts. Curve 1, unity power factor; Curve 2, at 0.10 power factor, and Curve 3, at 0.80 power factor. 60 cycles.



(b) 132,000 to 63.5 volts. Curve 1, unity power factor; Curve 2, 0.25 power factor. 60 cycles.

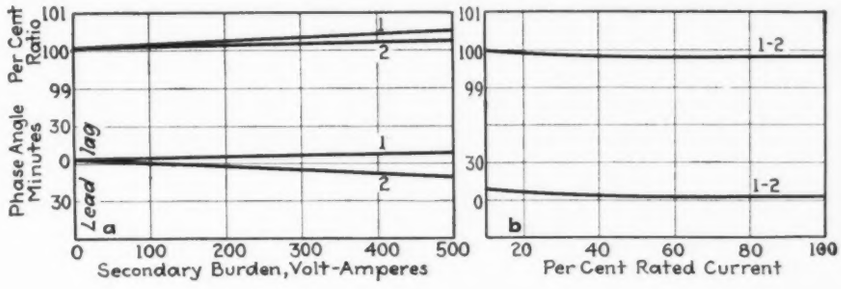
(c) Curve 1, 10 v.-a. 0.80 power factor secondary burden; Curve 2, 10 v.-a. 0.90 power factor secondary burden. Curve 3, 10 v.-a. 1.00 power factor secondary burden.

(d) Curve 1, 25 v.-a. 0.80 power factor secondary burden; Curve 2, 25 v.-a. 0.90 power factor secondary burden; Curve 3, 25 v.-a. 1.00 power factor secondary burden.



(a) 132,000 volts to 110 volts. Curve 1, 1.00 power factor; Curve 2, 0.10 power factor.

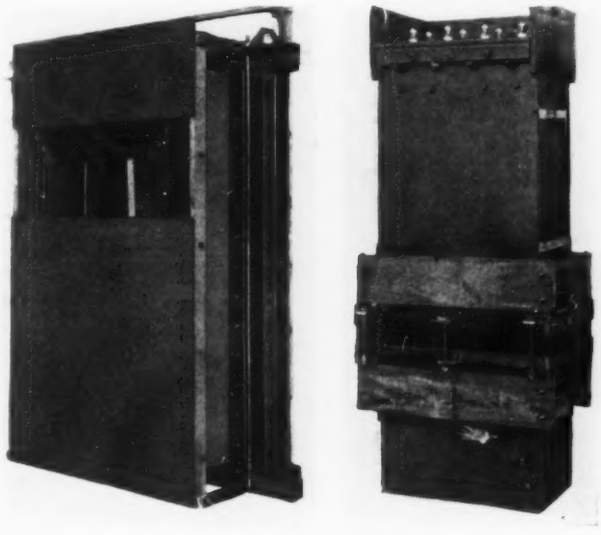
(b) Curve 1, 25 v.-a. 0.70 power factor; Curve 2, 50 v.-a. 0.80 power factor.



Performance of Danville Type of Metering Transformer

capacity, with ratio 132,000 to 63.5 and 110 volts. The current transformers are 50 volt-ampere capacity, with ratios 150-300-600 to 5 amp. Although the capacity is small and represents only a small fractional part of the actual power passing over the system, each unit is comparable to a sizable power transformer, with an over-all diameter of 103 in. and a height of 265 in. from base to bushing tip. The complete weight is 42,000 lb. The accompanying charts are typical of the performance of the current and potential elements over any possible range of burden and power factor which may be applied to the secondary leads and indicate that at ordinary meter burdens the accuracy is exceptionally good and the correction factors very small.

Since the installation of the Philadelphia units, a similar application has been made by the Appalachian Electric Power Company at Danville, Va. The potential transformers are rated at 500 volt-amperes, with ratio 132,000 to 110 and 190.5 volts and current transformers are rated at 50 volt-amperes, 150-300 to 5 amp. These units are also for connection on a 220-kv. three-phase, 60-cycle system, with neutral either grounded or free. The potential elements are fully insulated at both ends and high-voltage outlet bushings of the same class are supplied on each end, whereas the Philadelphia units have reduced voltage bushings at the grounded end. Each unit contains both current and potential transformer elements, weighs 50,000 lb. and requires a floor space 92x 120 in. The over-all height is 247 in. The accuracy of performance is similar to the units first described.



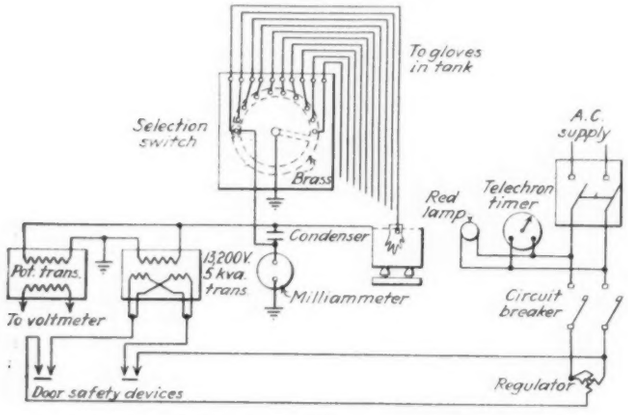
Current and Potential Transformers Ready for Assembly in a Case

Ratio and phase angle characteristics were determined by comparison with calibrated standards. The calibrated standard used on the potential elements was designed and built at Sharon, Pa., and calibrated in the laboratory of the Bureau of Standards at Washington, D. C. This calibrated standard is suitable for a range of standard voltages from 44,000 up to and including 154,000 volts for both 25 and 60 cycles.

Determining Leakage Current in Rubber Glove Tests

By W. Jordan

Superintendent Electric Meter and Test Department, Westchester Lighting Company

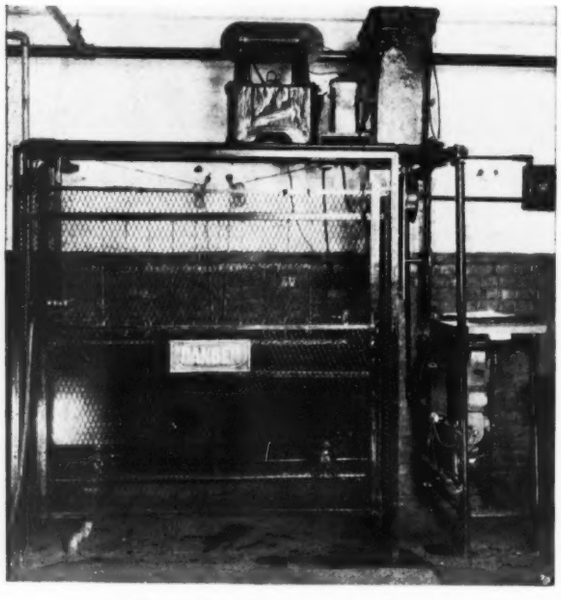


Grounded Tank and Selector Switch Give Direct Glove Leakage Reading

Brass ring, mounted on bakelite disk, rotated over segments selects one glove for milliampere indication and grounds all others.

IN ORDER to measure leakage current of individual gloves the Westchester Lighting Company has insulated the glove-testing tank from ground and raised it to the potential of the test transformer, 10,000 volts. The electrodes inside the gloves are the grounded side of the circuit and all except the one glove for which leakage reading is being taken are at ground potential. A selector switch connects the gloves in sequence through milliammeter to ground. A 6-in. bakelite extension of the selector switch shaft gives the operator protection in addition to the grounding of the metallic shaft and the non-current-carrying parts.

In order to read the leakage current with fair precision and still have an instrument which will stand the shock of heavy current on the failure of a glove a 75-milliampere instrument is used and a middle-scale reading is forced by the continuous passage through the instrument of 30 milliamperes from a 10,000-volt condenser in parallel with the gloves. The instrument used is a standard a.-c. voltmeter which requires 75 milliamperes for full scale deflection and a drop of 150 volts.

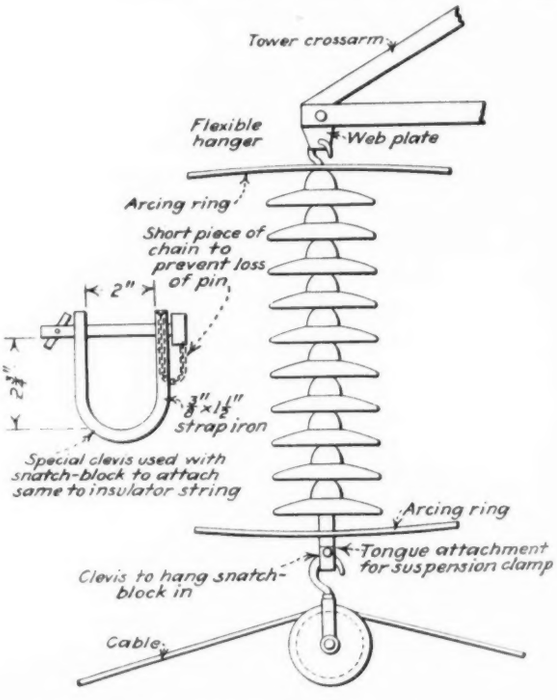


Glove-Testing Equipment

Transformer, condenser and protective gap on roof of tank inclosure; door interlocked with primary circuit of transformer.

Simplifying Stringing of Conductors

IN STRINGING conductors on steel towers the customary procedure is to pull out the conductor on the ground, raise it up onto the tower and then set it in snatch-blocks which are hung from the tower arm by a chain. After the conductor has been properly sagged



Attaching Snatch-Block to Insulator String Facilitates Stringing of Conductor Cables

it is transferred to the clamps at the ends of the insulator strings. By a slight diversion from this practice the Hoosier Engineering Company has been able to realize a small but worth-while saving. The snatch-block is attached to the end of the insulator string in the position in which the conductor clamp will later be set. Then the conductor is put into the block and the whole assembly is raised to the arm. The insulator is permanently fixed to the arm and the sagging done as usual. For clamping in, the conductor is lifted out of the snatch-block and held with a hand line while the block is removed from the end of the string and the conductor clamp substituted for it. This method does away with the necessity of lifting the insulator and the conductor separately to the arm, both going up together in the new practice. Also it makes a material reduction in the quantity of equipment used in stringing, the numerous pieces of hanger chain being dispensed with.

What Railroads Expect of Power Companies

An Interview with
SIDNEY WITHINGTON
Electrical Engineer
New York, New Haven & Hartford Railroad

When attempts are first made to induce any industry group to purchase power, there is always the possibility that considerable delay will be encountered in reaching agreement on terms because of lack of understanding of each other's problems. This has been true of efforts to write mutually satisfactory contracts covering purchase of power for steam railroad electrification.

In some cases the railroads have not comprehended the power companies' problem and have held out for certain contractual stipulations that work a hardship on the power supply company. Just as many cases have arisen, probably, in which the power company has insisted on certain requirements because it did not realize the railroad's operating problem.

In the belief that exchange of viewpoints will clarify the problem, some comments of Sidney Withington, electrical engineer of the N. Y., N. H. & H. R.R., have been solicited on "what railroad requirements must be taken into consideration in framing power contracts," and are presented here. Mr. Withington says:

"ONE of the chief questions which arises in developing a rate structure is the allocation of costs among various classes of service. In addition to the technical features involved, there are economic and political questions which must be given careful consideration. For instance, there is a natural tendency under some conditions to favor domestic customers at the expense of larger users of power, with the idea of increasing good feeling toward the company among the voting body, and thus reducing chances of possible embarrassment from political sources. On the other hand, rates for large blocks of power are to some extent often competitive, no matter how complete may be the so-called monopoly enjoyed by the power company. The manufacturer, unlike the householder, usually enjoys a real economic choice between purchase and production of his power requirements. This is especially true if he requires steam for his manufacturing processes as well as for heating his plant in winter.

"Railroads operating territories with electric traction are in many respects in a class by themselves as potential purchasers of power. The railroads' electric traction load is usually a relatively large one and possesses rather radical differences in characteristics as compared with the ordinary industrial load.

"It is desirable from many points of view for the railroads to purchase their power requirements if favorable arrangements can be made, rather than developing facilities for their own power production. Possibly the most important single argument in favor of purchasing power for electric operation is the avoidance of the necessity for the relatively large capital expenditure required for the power plant and associated facilities at a time when the capital requirements are naturally heavy. The railroad must itself finance its power distribution expenses, which are likely to be heavy, but, if favorable terms are offered, can allow the power company to finance the power plant, and under some conditions the transmission system and substations. The financing of locomotives or motor cars can often be taken care of on the basis of an equipment trust. Some such division of financing burdens may make practicable a given electrification project which otherwise could not be considered purely on account of the heavy burden in financing it.

"Another important presumptive consideration in favor of purchased power is the somewhat obvious one that since power companies are specialists in producing power on a 'quantity production' basis they may be expected to produce a kilowatt-hour more economically than can the railroad, for which power production is but a side line. There is no question that quantity production makes for economy, and no group knows this better than the railroads themselves. It is this that allows them to carry a ton of freight 5 miles for the price of a package of chewing gum. The ever-increasing thermal efficiency of the modern power plant which produces a kilowatt-hour for less than a pound of coal is to some extent discounted by the

increasing capital cost of power plant installation in spite of added effectiveness of interconnections in producing economies. Under most circumstances the railroads cannot expect to attain any such high efficiency of production in units of the economic size for their requirements. On the other hand, the very fact of relatively small units means less investment in reserve capacity. Two-hundred-thousand-kilowatt machine units mean at best large capital charges for stand-by capacity. The switching facilities, moreover, for the modern central station are far more elaborate than those required for railroad operation alone, and this may be an important item to consider.

"It is true that a distinct advantage rests with the organization which specializes in power production as compared with that for which power production is a by-product. In the former case the technical staff has the full support of the executives, whereas in the latter instance too often the executives, brought up with other interests paramount, do not pay much heed to the needs of the power organization, which is likely to suffer reduced efficiency accordingly.

"The power company representatives are in the true sense of the word specialists in power production; nevertheless the problems met in electric traction are in some respects quite different from those normally encountered in central-station practice, and any commercial power plant force might well be somewhat puzzled in meeting the railroad demands satisfactorily until they had accumulated considerable experience in that particular branch of power production and utilization. The abnormal conditions resulting from interruptions on a system where power is delivered to fast-moving trains are of an entirely different order from those of the normal power system, and correspondingly elaborate protective installations and maintenance measures are necessary in order to insure satisfactory operation.

"No contract should be tolerated which is not advantageous to both parties involved. If all power negotiations are approached by both parties with this broad idea firmly in mind there is in this age of specialization little question, except in perhaps a few individual instances, that all future railroad electrifications will be operated by means of purchased power, delivered probably to the distribution system of the railroad by the power company in the form in which it is to be utilized."

How Railroad Would Handle Supply

"A railroad in designing its electric traction system on the basis of producing its own power would naturally locate its power plant at the center of its load and adjacent to its tracks and distribute the power in either direction along the right-of-way. If the electric zone includes a network of routes, the road may give itself the benefit of ring feeders. It may be found desirable to arrange auxiliary supplies at the ends of the zone so that service may be continued in the event that the line is cut in two by an emergency such as a derailment or a serious fire adjacent to the property. If the power is purchased, the power company's central station may not be located adjacent to the railroad or near the center of load, in which event a considerable distance of transmission may be necessary, and this would obviously be a charge against the purchase of power in comparison with estimated cost for power production by the railroad. This disadvantage, however, in any individual instance may well be offset by the possibility of using the transmission network of the power company and supplying the railroad substations at strategic points. This latter arrangement would have the advantage of multiple transmission circuits independent of conditions on the railroad right-of-way and should produce satisfactory reliability. The joint use of transmission facilities and substations among various classes of service often makes such a method of supply very economical.

"The power companies in figuring the cost of supply for a given electrification project must obviously produce a figure which, all things considered, will be attractive to the railroad management, if it is to be induced to discard consideration of installation of its own power facilities. The cost of a kilowatt-hour delivered to the trolley wire may be readily estimated by the railroad engineers, and these are the figures which the power company must meet. In making the comparison, the fixed or capital charges on the railroad-owned power plant and associated facilities, including interest and depreciation, must be calculated in much the same manner as the power companies' own representatives would compute them.

"It is probably true that the interest rate which the power company is allowed to pay is usually considerably higher than the railroad company pays to its own stockholders or at which it can borrow to construct its plant facilities. This higher interest rate may be sufficient to decide the question against the power company unless balanced by other advantages or economies presented in the power company's proposal. The estimates in connection with charges for depreciation or contributions for replacements should not be very different whether the railroad or the power company is to own the power plant facilities. As regards transmission, it should be borne in mind that the railroad transmission would be located on the supporting structures required to carry the trolley contact system, and that the increment only in foundations and steelwork, etc., would be thus chargeable to the transmission account in any comparison which might be made.

"In figuring secondary or production costs, relatively high plant efficiency, both of fuel and labor, should give the power company considerable advantage over the railroad-operated plant. It should be noted, however, that in the purchase of fuel the railroad often can obtain a lower price than can the power company, on account of quantity purchase. It is also true that while the railroad pays full off-line freight charges for fuel, it can justify actual out-of-pocket or increment expenses only, for transportation over its own lines, and can thus deliver fuel 'alongside' at a cost probably relatively considerably lower than can a neighboring power company. As a converse to this, of course, all fuel transported to the power company's plant for the railroad's load represents so much gross income at regular freight rates, *provided* it is transported over the right railroad. It is possible that a proper clause might be included in the agreement to insure this reciprocity.

"The railroad, of course, exercises control over its fuel costs. In any agreement for purchasing power there would probably be included a fuel clause. The railroad should, if possible, have assurance of protection against abnormal or unjustified fuel prices paid by the power company. This may be difficult to express in definite

terms, and it is true that in some cases, at least, the government regulatory body would protect the railroad together with other power customers in this regard to prevent abuses in such instances.

"The railroad production costs are, of course, net. If the power company attempts to include any considerable item of profit or overhead in its secondary charge it may eliminate many of the advantages in economy of production which naturally exist. Under ideal conditions the power company should obtain its 'profit' entirely from the primary or capital charge, including in the secondary or energy charge only production costs. Indeed, in some of the recent traction power contracts the secondary rate is merely the *actual* unit production cost figured each month. In this event there is no item added for contingencies, for the railroad is virtually a partner in the enterprise with the power company, which obtains its agreed profit or interest on capital entirely from the primary charge.

"In instances of this kind care must be taken to insure against extravagant management, but here again there is usually some protection through regulatory bodies.

"The railroad in purchasing power obviously sacrifices a certain amount of flexibility as compared with operating its own generating plant, for it is of course rigidly bound by the terms of any arrangement it may make with the power company over a term of years. For this reason the agreement should be as flexible as possible and should contain as few 'guarantees' as possible consistent with proper protection of the power company's interests. For instance, if the railroad were to design and build its own facilities it would install capacity sufficient to take care of reasonable demands, in all probability relying upon the normal reserve capacity, and especially taking advantage of the overload capacity of individual units, to carry abnormal peak loads. This being the case, and in consideration of the diversity of railroad load as compared with other industrial loads on the power company system, the measurement of demand should be as flexible as possible.

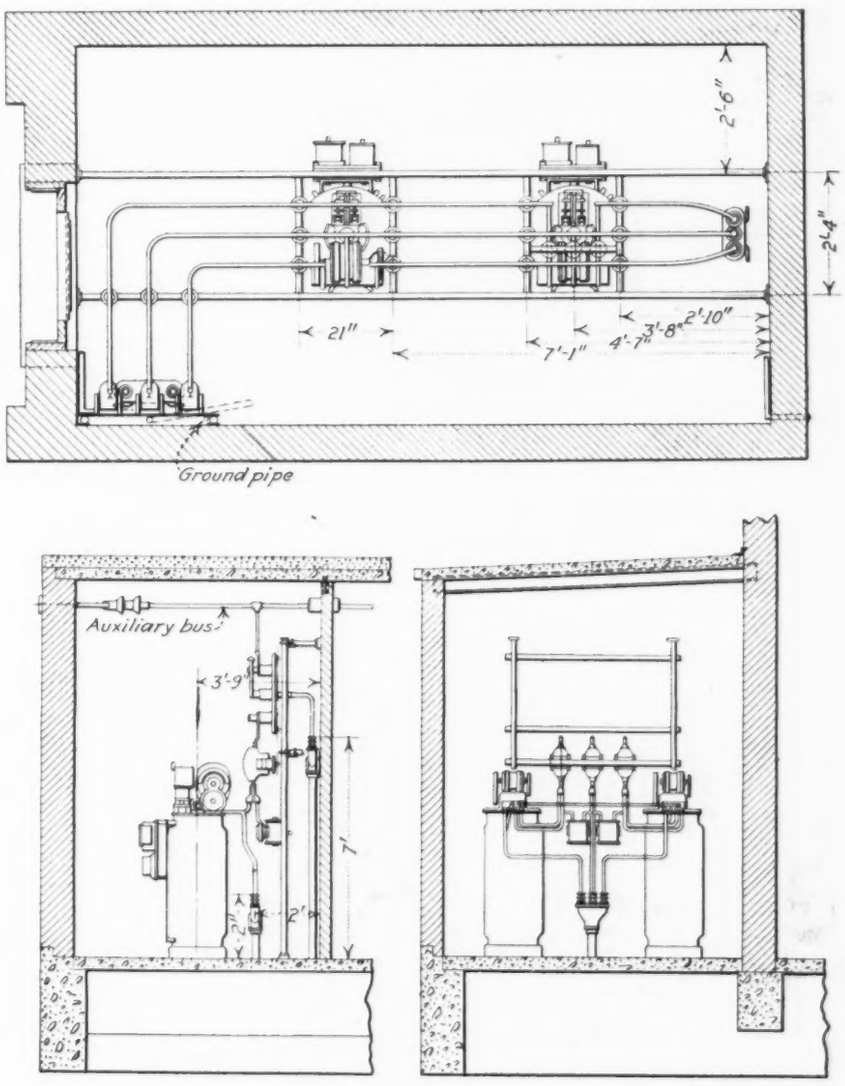
"Some important power contracts contemplate the average of four peak-hour loads per month in the establishing of monthly demand, and some even more than this, but there is a tendency in the recent more important contracts to fix on the average of *three* normal demands in each month (usually clock hours for convenience), disregarding abnormal demands which may be supplied by the power company as they arise, only if it has sufficient reserve capacity available. The old custom of penalizing the railroad on the basis of a single (perhaps accidental) demand for a year or more is entirely obsolete and has been discredited by power companies and railroads alike.

Compact But Accessible Regulator Arrangement

A RADICAL departure in layout of the feeder regulator compartment has been made by the United Illuminating Company in a recent substation in Bridgeport, Conn.

The sides and rear views, when contrasted with the view of the old arrangement from above, show how the following improvements resulted: (1) Eighteen bus supports eliminated; (2) compartment length shortened 5 ft.; (3) hazard of exposed bus eliminated; (4) pipe framework reduced 80 per cent in amount; (5) labor costs decreased 10 per cent. Other incidental economies and advantages have been secured through the rearrangement.

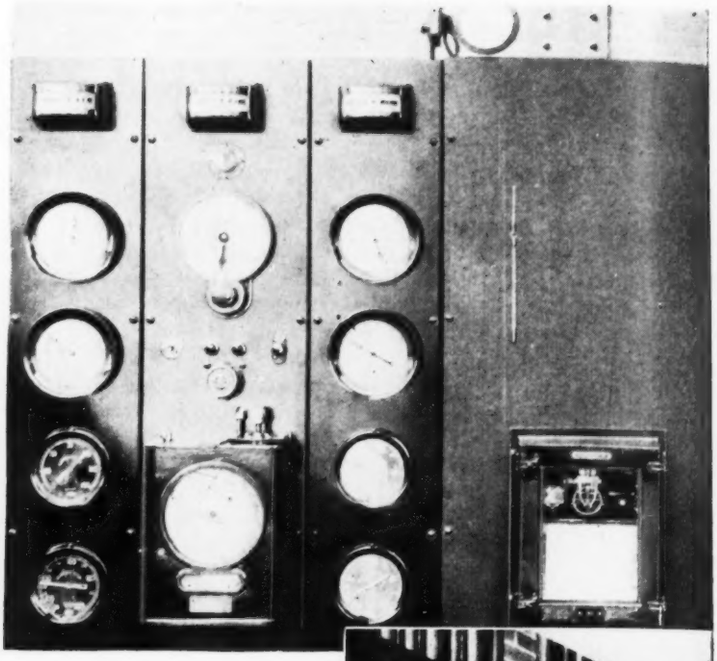
It is not felt that any new hazards have been created by consolidating the accessory devices on pipe frames behind the regulators in this manner. The policy is still maintained of housing each set of regulators in a separate compartment.



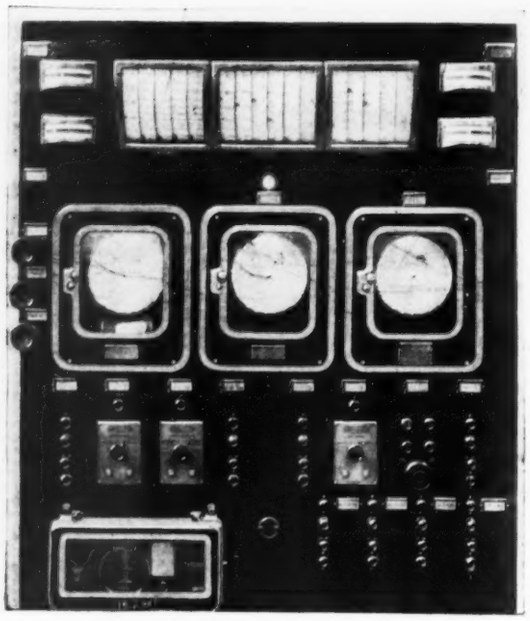
Space, Time and Material Reduced by Rearrangement of Regulators

Above is the previous arrangement with feeder entrance and exit at opposite ends. Below are side and rear views of more economical layout now employed.

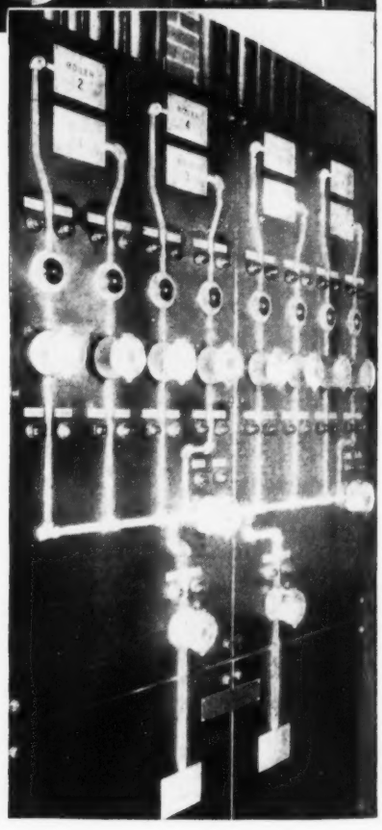
Grouped Control Facilitates Plant Operation



Gage board serving two turbo-generating units. The central panel carries a recorder of air and stator temperatures for both units. The three panels grouped at the left carry various steam, vacuum, temperature and pressure gages, indicating wattmeters and engine telegraph for one unit

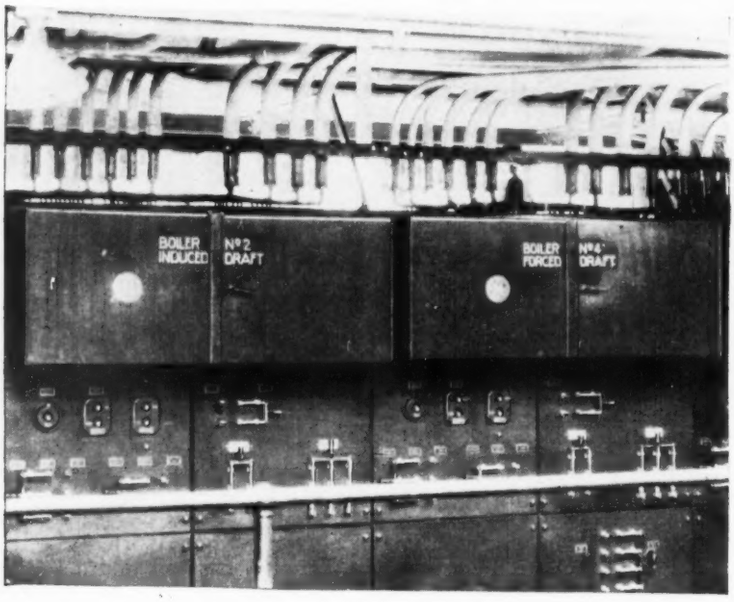


Gage board for one boiler, with air and steam flow meters, control for draft and coal feeding apparatus, automatic safety valve control and combustion metering equipment



Steam valve control panel with push buttons, pilot lights, dummy boilers and piping scheme

Control board for fans and feeders of combustion system



STEAM PLANT designers are establishing many notable examples of measurement and control functions on the boiler room and turbine side of the house. Operating convenience is greatly facilitated and easier handling of machinery and greatly increased speed in obtaining and studying instrumental readings result. The Somerset station of the Montaup Electric Company, designed and built by the Stone & Webster Engineering Corporation, Boston, illustrates this trend.

At the Business Conference in Washington on December 5 leaders presented reports on industry conditions. The utilities were represented by Matthew S. Sloan, president of the National Electric Light Association and president of the New York Edison Company. His remarks offer a very encouraging outlook for utilities in 1930.—Editors.

Utilities Will Act

M. S. Sloan reports healthy condition to Washington Business Conference. Future depends upon public confidence. To spend $865,000,000 in 1930

AS PRESIDENT HOOVER was informed on November 27, the public utilities of the country, meaning the electric light and power, manufactured and natural gas and electric railway companies, will spend $1,400,000,000 during 1930 for new construction, an increase of $110,000,000 over 1929. In addition they will spend for maintenance $410,000,000.

Speaking generally, the public utilities are healthy. Business during 1929 has grown normally and there is no reason apparent why it should not continue to do so during 1930. The electric utilities will spend $865,000,000, an increase of $65,000,000 over 1929. In addition, they will spend $125,000,000 for maintenance. This program represents normal provision to care for the power demands of the nation's homes and workplaces. It is estimated that expenditures for 1929 for all purposes—construction, maintenance, wages, taxes, fuel and other costs—will amount to $2,100,000,000. For 1930 these expenditures will be several hundred thousand dollars more. All sections of the country and almost every community will benefit from these expenditures.

Financing the power industry's great program for 1930 and subsequent years will depend essentially on public confidence in the utility companies and in the future of electrical development. The best information available shows that approximately three million citizens are investors in electric utilities' securities, besides large indirect participation through trust and endowment funds, insurance companies, savings banks, and the like. Company executives report that in the last two months the number of investors has increased largely, many paying cash for securities, though time payments were offered.

Certain trends of the business are especially gratifying. It is estimated that the total production of electricity during the present year will amount to 98,000,000,000 kw.-hr., an increase of 9 per cent. This total is almost as much as the amount of electricity used by all the rest of the world. During the year 800,000 new domestic consumers have been added to the lines of the companies. An increase of 16 per cent in domestic use of electricity has been registered and an increase of 8 per cent in the average use per consumer. The companies are aggressively seeking by promotional rates and advertising of labor-saving appliances to develop the domestic load, and confidently expect that this will be enlarged manyfold in a few years.

Industry is now three-quarters electrified, and two out of three horsepower supplied to the motors of industry are purchased from the power companies. New and improved industrial processes, the country's industrial expansion and the replacement of factory power plants by central-station service will continue the growth in this field. Requirements in other fields are expanding. Large railroad electrification projects are under way. Airway and airport lighting and highway lighting are increasingly important. Farm electrification is proceeding rapidly. In the last three years 250,000 farms have been reached and electric energy is used not only in farmhouses but increasingly for the performance of farm work.

While industrial consumption of current varies with general industrial activities, about 40 per cent of the

output is only slightly affected by business conditions. This is sold for home and store use, street lighting, street railway and railroad operation, and the like. It yields two-thirds of the gross revenue of the business and is a great stabilizing element in utilizing company facilities.

Technically, the electric utility industry is highly proficient and utilities and the electric manufacturing companies expend large sums in research for improvement in the art and for development of new applications of electricity. The results of research and the efficiencies attained through consolidations and large scale operation contribute to constant expansion and improvement of service, reduction in rates and maintenance of a sound financial position of the companies. The average price of household electricity is now 28 per cent below the pre-war level, a reduction of five points having been effected this year.

The constant effort of the industry is to grow by reason of high quality service and lowering of prices as increased efficiency and larger sales permit. Speaking conservatively, no business with a more brilliant future can be seen. It contributes basically to industrial growth and community development, progressing as the nation progresses. It endeavors to earn growth and development by deserving them, and public acceptance of its policies and practices is indicated by steady annual increase in sales. On that basis the industry looks with confidence to the future and can be depended on to continue its job of serving as the country's power plant.

Merchandising Pays Its Way

Residence consumption and revenue increased, compensation of employees raised and cost of selling appliances reduced

By C. J. Strike
Vice-President and Sales Manager
Northwestern Public Service Company, Huron, S. D.

AN INCREASED consumption of 49.3 kw.-hr. per residence customer for 1928 over 1927 plus a net profit of 6.4 per cent is the merchandising record of a central station serving a territory that is neither rich nor populous. The Northwestern Public Service Company serves at wholesale and retail more than one hundred cities, towns and villages in South Dakota and Nebraska. Electrical merchandise carries approximately the same margin of profit as other lines of merchandise and this company believes that if properly managed it should pay its own way; that is, should pay its proportionate share of general expenses, such as book-keeping, light, heat, rent, and at the same time show a fair margin of merchandising profit.

Up until August of 1927 our commercial department operated largely as a separate and independent unit, distinct and different from all other divisions of the organization. In this method of operation, merchandise salesmen were considered a necessary evil, merchandising profits were so small as to be almost non-existent and the curve of kilowatt-hour sales per resident customer had little, if any, upward tendency. Because of the lack of industrial load in the territory the problem of development became serious, and the company executives realized that if development was to be had it must come through the increased use of electricity by residential customers. Obviously the solution could not be reached by increasing the personnel of the sales department to such an extent that effective selling contact could be had with all of the customers in so sparsely settled a territory, yet that contact was necessary if appliances were to be put on the lines in sufficient quantity to increase materially the revenue per customer.

The operating department of the company had men stationed throughout the territory; meter readers, linemen, distribution operators, etc. These men were in rather intimate and continuous contact with the public in their respective districts. Why should not that contact be capitalized for the benefit of the sales department? It took considerable work and demonstration to persuade the operating department that the idea might contain some merit, and that eventually all departments would be benefited, for as the company develops it is possible to pass on rate reductions to the customers and increased wages to employees.

Operating Men Develop Commercial Abilities

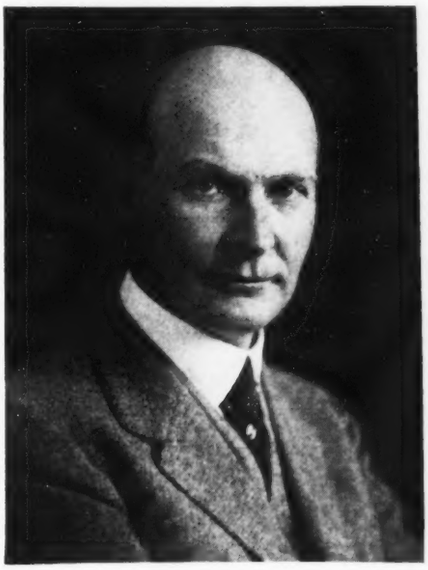
A comparatively large number of the local operating men were earning small salaries simply because their operating duties were not sufficient to take their full time. They had time available for sales work, and here was an opportunity for them not only to improve their positions but also to increase their pay checks to an appreciable degree. After the plan had been in operation for a short time it was found that the operating department, by permitting its men to engage in commercial activities, could place employees at locations which heretofore were not sufficiently important to justify a man on operating duty alone, although on various occasions of emergency it would have been desirable to have men at these points. The first duty of these employees is to the operating department. They get out and sell during their spare time and they operate on a time sheet basis. Such time as is put in on operation is charged to the operating department and the balance of their time is charged to the sales department.

Under this plan the selling expense of the commercial department has been materially reduced in spite of the fact that many operating employees will receive additional compensation from that department. A portion of each meter reader's salary is charged to commercial expense, thereby reducing the cost of meter reading to the operating department. After giving this plan a year's trial it has been concluded that it is practical in every respect and works to the benefit of all departments.

Under this plan the unit operating department cost has been reduced and more men are stationed throughout the property and are available for operating emergencies than under the old plan. In addition, the cost of salesmen's salaries and commissions, which in previous years, when the commercial department was operated separately, ranged from 12 per cent to 15 per cent of the gross merchandise sales, under the new arrangement has dropped approximately to 7½ per cent. Merchandise sales increased 32 per cent and merchandise net earnings increased 70 per cent. The increase in kilowatt-hour per residence customer has been over 50 per cent. Included in the operating expense of the merchandise department are all salaries of the merchandise and new-business department throughout, as well as that portion of the operating department's payroll charged on a time-sheet basis to the sales department. Merchandising pays

50 per cent of the total light, heat and rent for the entire property and approximately 20 per cent of the total accounting expenditures. Aside from the economic aspects of the situation it has been found that the entire organization of the company has become imbued with the sales spirit, with the result that the efficiency of all departments has increased considerably. It has also been possible to promote a number of men from the operating department to the position of commercial managers on the various divisions. Many of the present commercial managers and salesmen were originally in the operating or accounting departments.

Connecticut Governor Opposes Couzens Bill



J. H. Trumbull

EXTENSION of federal activities into the field of state regulation is vigorously opposed by the Hon. J. H. Trumbull, Governor of Connecticut, who recently informed a representative of ELECTRICAL WORLD of his disapproval of the Couzens bill now pending in Congress.

"State regulation has worked well in Connecticut," said the Governor, "and future needs appear to be well cared for by the machinery which has been set up in that Commonwealth. Public sentiment in Connecticut is strongly opposed to building up a federal regulating machine to function on top of a competent state commission. I am absolutely opposed to the entry of the federal government into intrastate rate fields. It is difficult at this time to see any need of legislation along the lines of the Couzens bill, even in connection with the interstate transmission of power. Other methods of regulating interstate power contracts have been designed which promise far more success than putting such matters in the jurisdiction of such a federal commission as Senator Couzens proposes. A number of New England power companies have already volunteered to place the regulation of their interstate power contracts in the hands of the commissions functioning on each side of the state line, and I see no need of setting up a Washington body for this purpose.

"Nor do I see any need at present of federal regulation of holding company securities."

Power Requirements for Electric Galvanizing

ASSUME a galvanizing shop having a production of structural steel shapes to be galvanized that require a tank having inside dimensions of 3 ft. wide, 3 ft. deep and 15 ft. long.

Assumed data:

1. Production, 3,000 lb. per hour.
2. Zinc added, 200 lb. per hour.
3. Temperature, 850 deg. F.
4. Size of tank, 3 ft. wide x 3 ft. deep x 15 ft. long.
5. Working schedule, 24 hours per day.

Absorption of Steel:

$$\frac{3{,}000 \times 13 \times 800}{3{,}412} = 92 \text{ kw.-hr. per hour.}$$

Absorption of zinc = 8 kw.-hr. per hour.

Standby losses:

Inside wall area of heating chamber = 200 sq.ft.

$$\frac{200 \times 1{,}000}{10{,}000} = 20 \text{ kw.-hr. wall loss (temperature of heating chamber, 1,000 deg. F.)}$$

Surface loss will average approximately 9½ watts per square inch of zinc surface at 850 deg. F. This figure will include losses from flange of tank.

Surface area = 36 × 180 = 6,500 sq.in.

Therefore: $\frac{6{,}500 \times 9.5}{1{,}000} = 61$ kw.-hr. surface losses per hour.

SUMMARY OF HEAT REQUIREMENTS PER HOUR

	Kw.-Hr. per Hour
Absorption of steel	92
Absorption of zinc	8
Losses	81
Total power consumption	181

Economy = $\frac{181}{1.5}$ = 121 kw.-hr. per ton.

Since the surface losses represent the major portion of the total losses, the top area of the tank should be made as small as possible to handle the given work.

In the above example, if the width should be made 2 ft. instead of 3 ft. the net economy would be 107 kw.-hr. per ton.

**As indicated in a paper, "Calculation and Operating Costs of Electric Furnaces," presented by R. M. Cherry of the General Electric Company at the Industrial Electric Heating School, Case School of Applied Science, Cleveland, Ohio.*

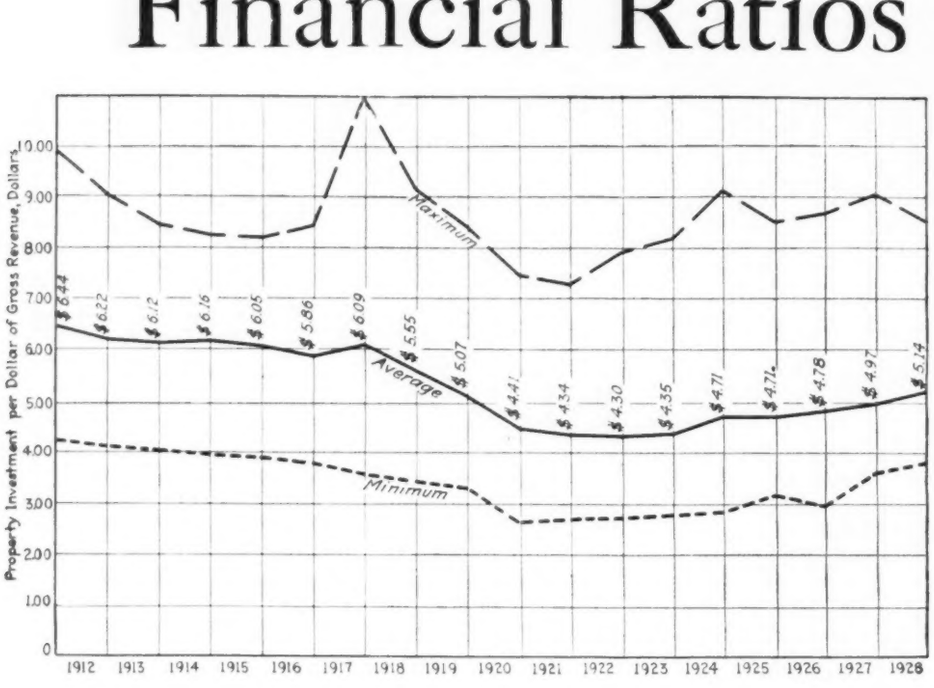
Electric Galvanizing Tank

General Electric 198-kw., three-phase furnace 15x3x3 ft., used for galvanizing structural steel and cast-iron parts (Delta-Star Electric Company plant)

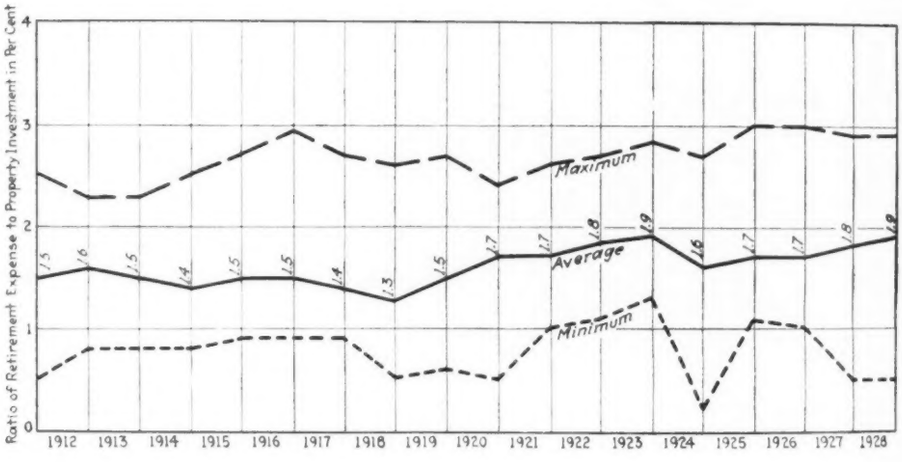
Financial Ratios and Cons

By
WILLIAM W. HANDY
Baltimore, Md.

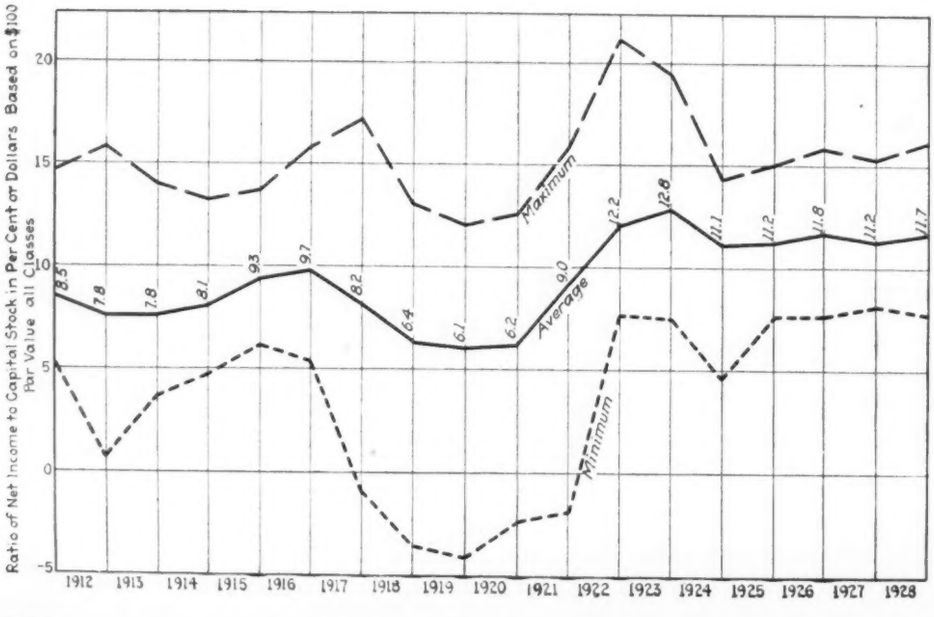
Operations of twenty major utilities exhibit long-time trends and changes



After an earlier downward trend the investment required per dollar of revenue has been gradually rising since 1922, despite improved load factor due to increasing use of off-peak appliances; rate reductions are going ahead faster than warranted.



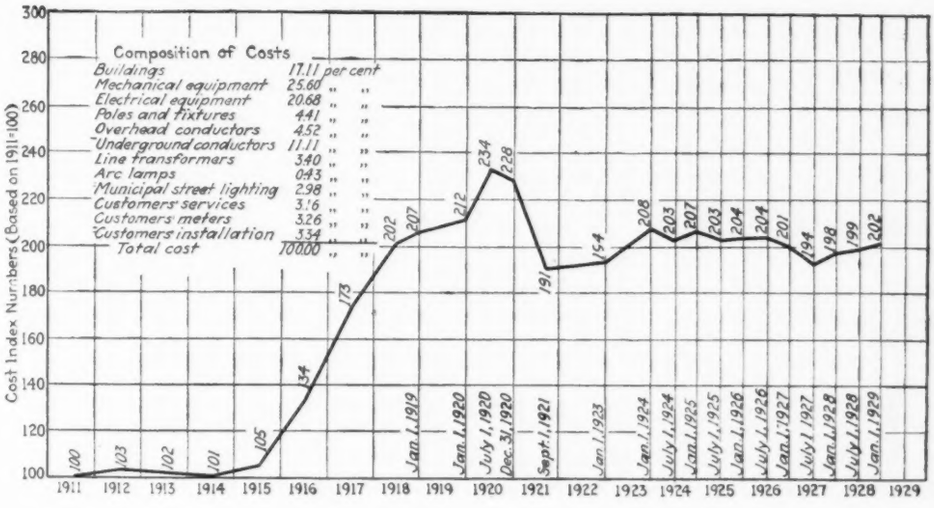
The increasing ratio of retirement expense to property investment is evidence of sound and conservative management. In 1928 the average for the companies investigated was 1.9 per cent; the range was from 0.5 to nearly 3 per cent.



Ratio of net income to capital stock, averaging 11.7 per cent for the twenty companies in 1928, is now on a higher level than during the previous decade, with much smaller annual fluctuations than during the war and price inflation periods.

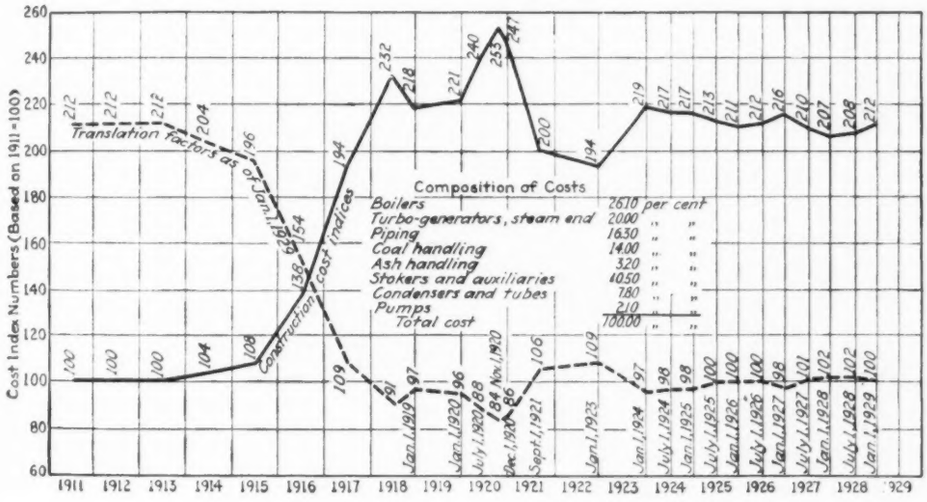
struction Costs Stabilized

Typical electrical utility construction costs shown as index numbers on 1911 base, for Atlantic Seaboard division

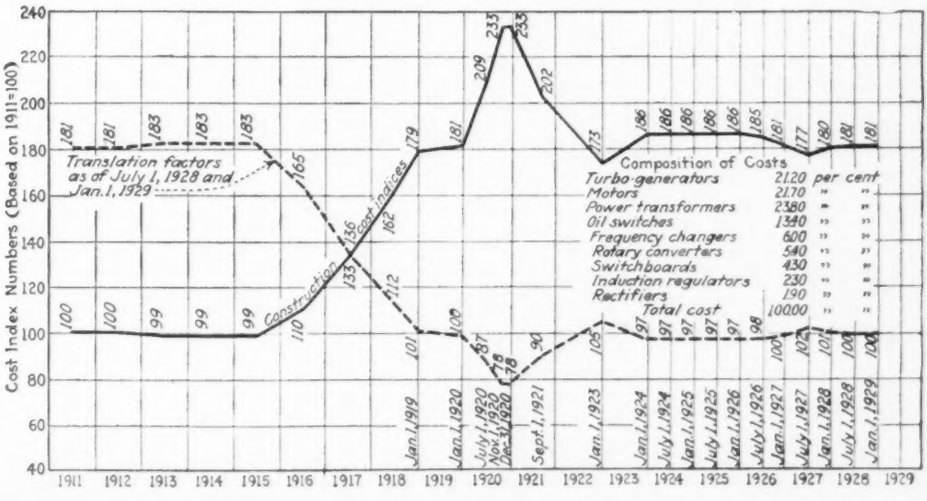

Composition of Costs
Buildings 17.11 per cent
Mechanical equipment 25.60 " "
Electrical equipment 20.68 " "
Poles and fixtures 4.41 " "
Overhead conductors 4.52 " "
Underground conductors 11.11 " "
Line transformers 3.40 " "
Arc lamps 0.43 " "
Municipal street lighting 2.98 " "
Customers' services 3.16 " "
Customers' meters 3.26 " "
Customers' installation 3.34 " "
Total cost 100.00 " "
Cost Index Numbers (Based on 1911=100)

From "The Yardstick of Public Utility Operations and Construction Costs." See ELECTRICAL WORLD, *page 895, November 2, 1929.*

Since the post-war fluctuation total construction and equipment costs have varied only slightly. They are now more than twice as great as before the war.


Translation factors as of Jan. 1, 1929
Construction cost indices
Composition of Costs
Boilers 26.10 per cent
Turbo-generators, steam and 20.00 " "
Piping 16.30 " "
Coal handling 14.00 " "
Ash handling 3.20 " "
Stokers and auxiliaries 10.50 " "
Condensers and tubes 7.80 " "
Pumps 2.10 " "
Total cost 100.00 " "
Cost Index Numbers (Based on 1911=100)

Mechanical equipment costs rose sharply from 1914 to 1920 and now stand at 212 per cent of the 1911 figures. Correspondingly, costs in 1911 and 1912 should be multiplied by 2.12 to get 1928 equivalent.


Translation factors as of July 1, 1928 and Jan. 1, 1929
Construction cost indices
Composition of Costs
Turbo-generators 21.20 per cent
Motors 21.70 " "
Power transformers 23.80 " "
Oil switches 13.40 " "
Frequency changers 6.00 " "
Rotary converters 5.40 " "
Switchboards 4.30 " "
Induction regulators 2.30 " "
Rectifiers 1.90 " "
Total cost 100.00 " "
Cost Index Numbers (Based on 1911=100)

Electrical equipment fluctuated similarly to other equipment, but on a 1911 base present costs are relatively not quite as high as those of mechanical equipment.

Picture Theories Inadequate

Theories built on physical conceptions have frequently failed to explain phenomena in the intra-atomic and stellar worlds so that a mathematical approach is becoming more attractive in handling complex phenomena

By Prof. Vladimir Karapetoff
Cornell University

WHEN dealing with objects and quantities capable of direct measurement, and having in mind "bulk" relationships, rather than a thorough-going ultra-microscopic interpretation, one uses mathematical concepts and expressions which directly correspond to the observed phenomena. For example, the motion of a spinning top may be observed and recorded in detail, and may also be expressed by differential equations the solution of which gives the same motion. When, however, it comes to the submicroscopic world or to remote portions of the universe, certain hypotheses are necessary which can be checked only on limited applications within the measurable world.

For a long time hypotheses made about the atomic and molecular structure have been of pictorial or "macrocosmo-morphic" (or "built like the big world") nature. To illustrate: In the big visual world we have central suns and planets, so we assume nuclei and revolving electrons within the atom. In the big world we have proximity action only (no action at a distance), so we think of revolving whirls in ether, geared to each other and propagating electromagnetic waves. In the big world an object occupies a definite space at a definite instant, so we think of an electron as a material point and ascribe to it a definite position and a definite velocity at a given instant. This sort of hypothesis dates from classical antiquity and the man in the street cannot even conceive of any other kind. Just as the primitive theogony is entirely anthropomorphic and justifies the statement that man has created God in his own image and likeness, so the naïve physicist describes the sub-atomic entities in terms of bulk concepts.

With the wonderful advance in the technique of physical and astronomical measurements, as well as with the liberation of thought toward more general and loftier concepts, the ordinary ideas borrowed from the "middle-size" world of experience have been found inadequate, both in the world of atoms and in the world of astronomy

However, with the wonderful advance in the technique of physical and astronomical measurements, as well as with the liberation of thought toward more general and loftier concepts, the ordinary ideas borrowed from the "middle-size" world of experience have been found inadequate, both in the world of atoms and in the world of astronomy. The greatest scientific minds begin to see another possibility of interpretation, the possibility of laws and relationships which hold only within extremely small confines of space and time, and also those which apply to extremely large dimensions and intervals of time. A surface may be smooth to touch, but extremely rough under the microscope. A portion of ocean surface may seem flat, but in reality is curved.

As another illustration, take the following picture: A rural community is excited over a crime committed in its midst and is storming a jail within which the culprit is confined. A being from another planet, who knows nothing about humans, observes their behavior and later describes each individual in terms of the collective mob behavior. Later this being learns to know many of the participants individually and finds them to be peace-loving men, kind to their families and neighbors. He made the mistake of ascribing to each particle the properties observed in an aggregate.

What kind of laws can then be ascribed to the submicroscopic and ultra-astronomical confines, if they cannot be checked by experiment, and if pictures based on the visual world are ruled out? There are at least two possibilities—to create grotesque pictures impossible in the world of experience or to propose purely mathematical functions and operations, forbidding their interpretation in terms of physical pictures. The first possibility has not been exploited as yet, but we are being ushered into an epoch of the second possibility, namely, that of purely mathematical hypotheses. I write certain mathematical functions, prescribe definite unheard-of operations to be performed on these functions, and say that these are the laws of atoms or of supergalaxies. Then I let you extend the results to the visual world and chuckle with satisfaction because (a) you have found your ordinary classical laws and relationships: (b) you have explained and predicted phenomena and numerical values unknown heretofore; (c) you have found certain detached laws to be but specific cases of a more general relationship.

This means, of course, that the proposed mathematical relationships must be asymptotic in their nature; that is, they must become identical with the generally accepted relationships when the size of the aggregate is increased (or decreased) to our "middle-size" world. Otherwise, there would be a break, with one set of laws holding

up to certain dimensions and another set beyond these dimensions. So far, there has been no occasion of accusing the "creative evolution" of such a jerky method of procedure.

Space and Time Conception Different

The new quantum mechanics with its probability basis, the principle of indeterminateness of either the position or the momentum of the electron, the new Einstein theory which created such a stir recently, all these are essentially mathematical hypotheses, and when they mention space and time, it is done in a manner not to be pictured according to our everyday experience. The success of these theories in predicting numerical relationships capable of measurement vouchsafes their value, and physicists are going to follow them until these ideas have been "sucked dry."

Later, such outlandish laws may become inadequate to explain certain phenomena, or else we may get so used to thinking in terms of mathematical operations that the premises will cease to seem odd. A reversion may occur to the picture theory, or else a new genius may introduce an entirely new principle which will reconcile our critical minds to the high-handed method of writing arbitrary formulas as a foundation of physics. For, after all, we can think of the universe only in terms of our mental categories of thinking, and the most general modes of thinking are probably mathematical propositions and formulas. Thus, mathematical hypotheses are perhaps more comprehensive than any physical mechanism that we could devise, and therefore may come more closely to that ultimate reality which is the despair of philosophers and of natural scientists.

To put this proposition in another form: Take two simple simultaneous equations, say, $2x + y = 6$; $3y - x = 11$. One can solve them, analyze the solution, and do many other things allowed by the rules of mathematics. But a man who likes to see a picture will not take much interest in this problem unless a story goes with it, about a merchant who bought x yards of cloth, his profit per yard was y, etc. Another picture type man may see the equations better in terms of two railroad trains which start from two stations distant x, etc. A third may prefer a story about a boy who is x years old and whose sister is y years older than he. Yet, the mathematical unity of the two equations comprises all these problems and far exceeds them in its generality.

Mathematics—the New Approach

The new point of view (of a mathematical start and of fitting phenomena into a set of formal expressions and operations) is essentially exclusive and aristocratic, because comparatively few physicists have the necessary mathematical equipment, ability, will power and leisure to keep up with a small crowd of *nouveau riche* who happened to have these qualifications from the beginning. It is also aristocratic because it requires dwelling in general concepts without trying to visualize them in terms of orbits, definite points, cogwheels, etc. For this reason, a reaction may set in before long. The common workers in physics, the submerged tenth, are going to revolt, and either hoist a new picture theory or turn away from the atomic physics into new fields where things can be measured in bulk, and where one can start a theory with the old-fashioned dx, dy, dz.

In the meanwhile those who are active workers in physics, as well as those who merely watch its progress from the outside, will do well to understand the nature of the present-day tendency, namely, a formal mathematical approach to intra-atomic and stellar phenomena, in order to do justice to the wonderful progress made within the last few years due to these new concepts and tools introduced.

Cost of Lighting Industrial Buildings

By M. Luckiesh
National Lamp Works of General Electric Company, Nela Park, Cleveland

IN A recent analysis of the cost of lighting industrial buildings we studied the costs of lighting six representative types of buildings—four single-story and two multi-story—for an eight-hour work period in the daytime and for average weather conditions. Artificial lighting was considered to be used only when the level of illumination by natural lighting fell below a certain prescribed minimum. Each row of units was assumed to be separately controllable so that artificial lighting could be added to the sections farthest from the windows first. Some conclusions derived from this analysis are briefly stated below:

When the minimum level of illumination desired upon the work-plane is less than about 10 or more than 75 foot-candles artificial lighting is the more economical if electrical energy costs 2 cents per kilowatt-hour or less. Between these limits, usually at about 38 foot-candles, the combined cost of natural and artificial lighting per foot-candle per hour attains a minimum. The expenditure which can be economically justified for natural lighting for a given condition depends upon the relative costs of building, real estate and electrical energy.

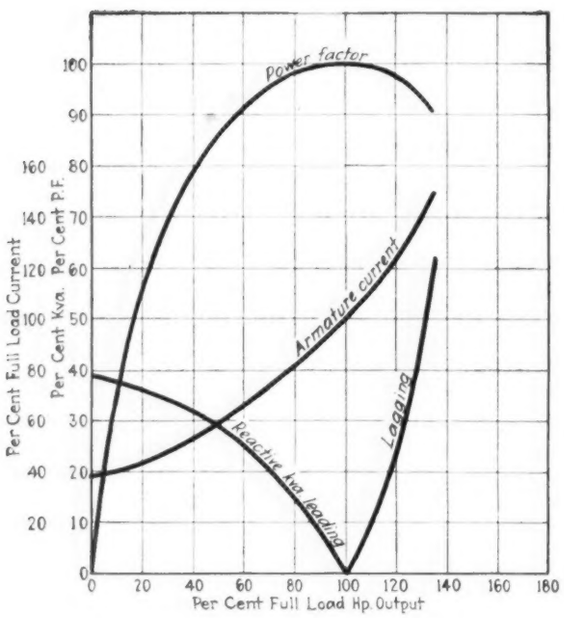
Under approximately average conditions it does not appear economical to equip a single-story building for natural lighting with anything more than windows in the walls when electrical energy costs less than 1.4 cents per kilowatt-hour. Monitor windows may be justifiable for rates above 1.8 cents per kilowatt-hour and sawtooth windows for rates above 2.2 cents per kilowatt-hour.

It does not appear economical to have the light court surrounding a six-story building of a greater width than the building height for the following relative costs of real estate and electrical energy:

	Per Sq Ft.		Cents per Kw.-Hr. or More
Real estate	$0.10	Energy	1.5
Real estate	0.40	Energy	1.7
Real estate	1.50	Energy	2.9

Since the cost of heat lost due to windows is generally offset by the cost of electrical energy saved by the incoming natural light, it is ordinarily justifiable to equip industrial buildings with simple side windows. In general, from the lighting standpoint, for the types of buildings investigated operating under average conditions, no appreciable expenditure is economically justifiable for natural lighting equipment when electrical energy can be purchased as low as 1.4 cents per kilowatt-hour.

Torque and Power Factor *Determine Synchronous M*

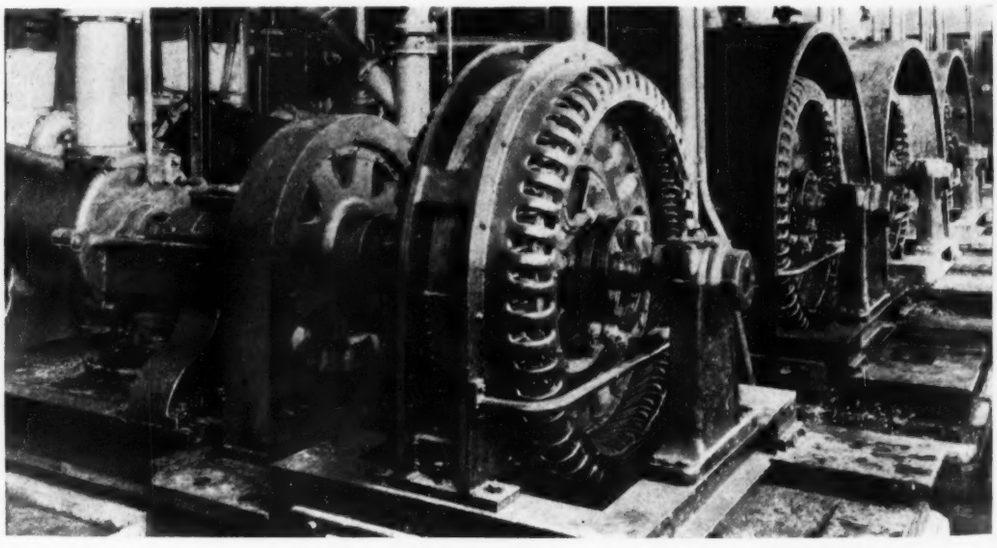


100 per Cent Power Factor Motor, Constant Normal Voltage and Field Current, Full Load

MODERN synchronous motors are available producing starting torque ranging from about 50 per cent to well above 200 per cent of full-load torque, pull-in torque ranging from 35 per cent to 110 to 125 per cent of full-load torque and with pull-out torque as high as 350 per cent and even 400 per cent of full-load torque. It is desirable, from an economic standpoint, when specifying these three quantities to keep them as low as is consistent with the application, with a reasonable factor of safety for varying voltage, etc., since an increase in any of the three factors involved results generally in a larger machine with increased first cost. Of course, in determining the starting torques of the motor, sufficient torque must be developed by the motor to insure starting and accelerating the load. The pull-in torque should be very nearly equal to the torque required to drive the machine under starting conditions, but at synchronous speed. Pull-in torque should be kept as low as possible, since high pull-in torque is accompanied by high starting current. Compared with a motor with 50 per cent starting torque, 40 per cent pull-in torque and 150 per cent pull-out torque, a motor with the same starting and pull-out torques but with 100 per cent pull-in torque would be about 15 per cent higher in price, the efficiency would be about three-tenths of 1 per cent lower at full load, while the starting current would be nearly twice that of the motor with the lower value of pull-in torque. For this reason it is advisable, if it can be done, to arrange to relieve the load as much as possible at start, thereby obtaining a less expensive motor and preventing possible voltage fluctuation.

Pull-Out Torque Requirements

The pull-out torque of the motor must be selected for the maximum peak-load conditions of the application. In determining the pull-out torque, it should be kept in mind that the maximum pull-out torque of the synchronous motor required to keep it in operation under low voltage conditions need not be as great as that of an induction motor, since the pull-out torque of the



350-Hp., 400-R.p.M. Motors Coupled to Jordan Engines in a Paper Mill

By E. C. Souder
Westinghouse Electric & Manufacturing Company

s Motor Selections

***THE RAPIDLY** growing demand for synchronous motors has been reflected in an equally rapid change in motor design. Synchronous motors are now applied to machinery that five years ago would have been considered utterly unfitted for synchronous motor drive.*

The first problem to be considered when applying a synchronous motor is that of selecting the proper torques for the drive. Three different values of torques must be given consideration: First, the starting torque, representing the ability of the motor to start the load; second, the pull-in torque, representing the ability of the motor to maintain operation during the change-over from induction to synchronous operation, and, third, the pull-out torque, representing the ability of the motor to maintain operation under peak-load conditions.

The starting and pull-in torques are characteristics of the motor operating as an induction motor and as such are closely related one to the other. The pull-out torque is a characteristic of the motor when operating as a synchronous motor, and while it is not closely allied to the two preceding values of torque, it does have some influence on the starting characteristics of the motor, particularly as regards inrush.

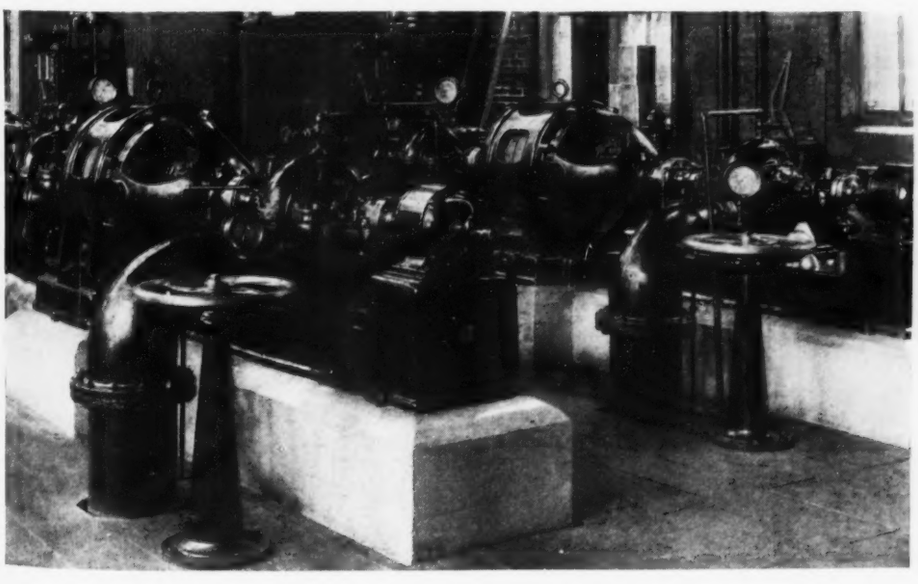
synchronous motor varies directly as the voltage, whereas that of the induction motor varies as the square of the voltage.

The pull-out torque of a synchronous motor is in direct relation to the field strength of the motor. Therefore, to obtain high pull-out torque it is necessary to build a larger machine, because of the increased heating resulting from the greater current that must be put through the field circuit. The pull-out torque also has an effect on the starting current required by the motor, the starting current increasing as the pull-out torque increases, assuming, of course, that constant values of starting and pull-in torque are maintained. Since the resistance and reactance of the rotor circuit are factors in determining all three values of torque, as well as the starting inrush, a change in design to change any one of the three torque values will be reflected by some change in the values of the other two torques and the inrush.

Thermal Capacity Important

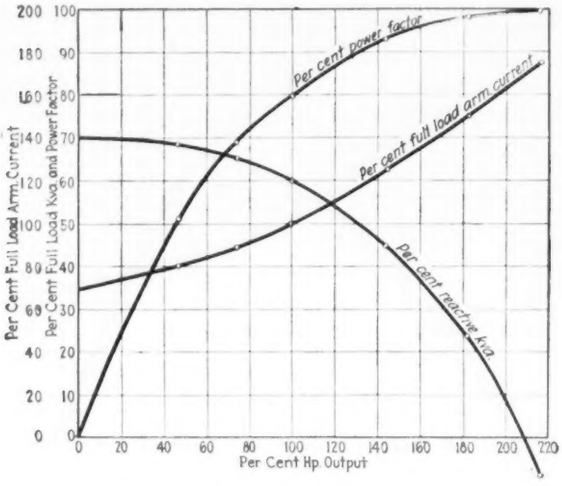
A motor designed with a high pull-out torque, while capable of handling high momentary overload, does not necessarily have more ability to handle a continuous overload. The increase in size of the motor required due to the high pull-out torque is occasioned because of the necessity of increasing the thermal capacity of the field. The thermal capacity of the armature or stator winding need not be increased in this proportion and can be designed more closely to meet the actual rating of the motor. Therefore, unless the stator has been designed for low temperature operation the stator will reach its permissible operating temperature under rated conditions and any continuous overload would cause it to overheat.

Probably the most important operating characteristic of the synchronous motor is its ability to operate at unity or at leading power factor. The unity power factor



200-Hp., 1,200-R.p.M. Motors Direct Connected to Pumps

motor, with moderate starting, pull-in and pull-out torque values (about 50 per cent starting, 40 per cent pull-in and 150 per cent pull-out) is the most economical synchronous motor that can be designed. The current circulating in the armature or stator is in phase with the line voltage and consequently for a given horsepower is the minimum value that can be obtained. With 150 per cent pull-out torque, the field capacity can be made very


Per Cent power factor
Per cent full load arm. current
Per cent reactive kva
Per Cent Full Load Arm. Current
Per Cent Full Load Kva. and Power Factor
Per Cent Hp. Output

Variation of Characteristics, with Full Load and Field Current Constant at Normal Value

small and consequently the actual physical proportions of the machine can be reduced to a minimum. A motor of this type will have lower first cost, higher performance and will require less excitation than will a leading power factor motor. A unity power factor motor does not have any marked ability to operate at leading power factor. Overexciting the field would result in increased field and armature current which would raise the operating temperature of the unity power factor motor above permissible limits.

In order to keep the heating of the motor within reasonable values a leading power factor motor must be larger than a unity power factor motor because of the increased current in both stator and field. The leading power factor motor will, therefore, have a higher cost, will require more excitation and will be less efficient. With the same approximate values of starting and pull-in torque, i.e., 50 per cent starting and 40 to 50 per cent pull-in, the 80 per cent power factor motor will be considerably larger and will cost from 25 to 30 per cent more than the unity power factor motor, the efficiencies will be from 1 to 1½ per cent lower at all loads and the exciter capacity required from 50 to 70 per cent greater. The 80 per cent power factor motor will, however, have a pull-out torque of at least 200 per cent of full-load torque. The increased first cost of the motor and exciter equipment and the higher operating cost due to the lower efficiency of the motor is, of course, to be balanced against the return obtained by the improved power factor.

As has been stated, an 80 per cent power factor motor requires more excitation than a unity power factor motor. The pull-out torque, therefore, on the 80 per cent power factor motor will be greater than will the pull-out torque on a unity power factor motor. Looking at this another way, high pull-out torque requires high excitation, therefore motors with high pull-out torques can with but slight modifications of the electrical characteristics be designed to operate at a leading power factor. This change in design may have little if any effect on the cost of the motor. The difference in efficiency of the leading power factor motor with high pull-out torque will not be as great as for motors with pull-out torques of around 150 per cent.

Again, because unity power factor machines are designed with the minimum amount of material, but little corrective effect can be obtained from unity power factor machines operating under-loaded but with full load excitation.

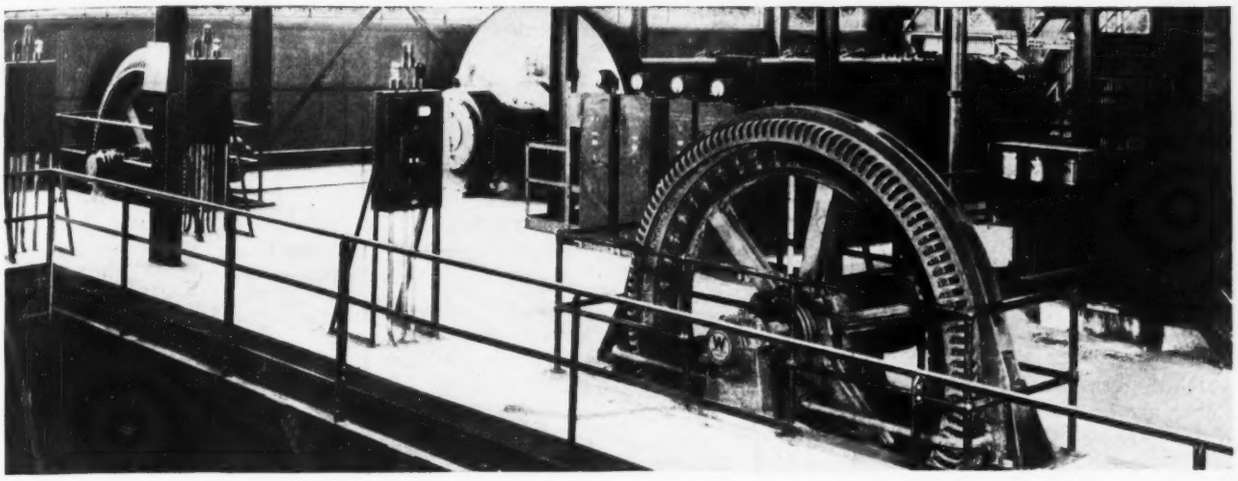
If it is desired to obtain any corrective effect with a synchronous motor it is always advisable to buy a leading power factor motor. Motor manufacturers have generally standardized on a value of 80 per cent leading power factor for motors to furnish corrective capacity, but motors of greater corrective effect can be obtained.

Temperature Ratings

Synchronous motors can be obtained with temperature ratings either 40 deg. C. or 50 deg. C., the former costing slightly more than the 50-deg. motor. It is the practice of most manufacturers to guarantee these temperatures without overload capacity, it, of course, being understood that a 40-deg. motor may be operated at higher than 40 deg. temperature. General practice is to design all

Table I—Variation of Efficiency, Excitation and Inrush for Unity and 80 per Cent Power Factor, 500-H.p., 200-R.p.M. Motor

Starting Torque, Per Cent	Pull-in Torque, Per Cent	Pull-out Torque, Per Cent	Inrush, Per Cent	Excitation, Kw.	Efficiency ½	Efficiency ¾	Efficiency 4/4
100 PER CENT POWER FACTOR							
50	40	150	275	7.5	91.9	92.8	93.0
50	100	150	500	6.0	91.3	92.7	92.7
100	50	250	425	12.0	90.9	92.3	93.1
125	100	250	575	9.5	90.6	92.4	93.4
80 PER CENT POWER FACTOR							
60	50	200	275	12.0	90.5	91.3	91.5
50	100	200	400	10.5	90.2	91.4	92.0
100	50	250	340	12.0	90.1	91.3	91.9
125	100	250	460	9.5	89.8	91.4	92.3



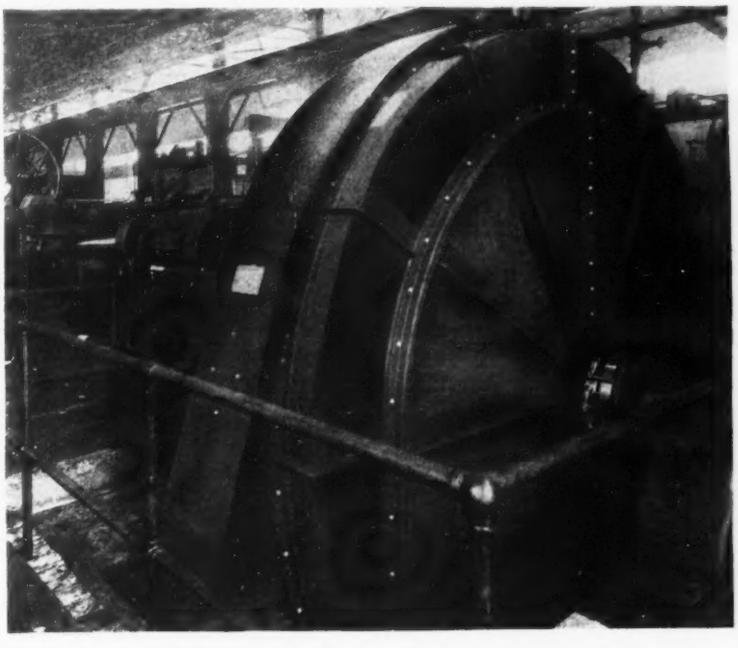
Synchronous Motors Driving Tube Mills in Raw Grinding Department of a Cement Plant

40-deg. unity power factor motors with pull-out torques not exceeding 150 per cent (175 per cent for motors above 400 r.p.m.) to have a temperature rise of 40 deg. on both the stator and the field. On unity power factor motors with pull-out torques greater than 150 per cent and on all 80 per cent power factor motors the usual practice is to design fields to operate at 50 deg. even though the stator temperature may be at 40 deg. This gives flexibility in correction.

A 50 deg. C. field on an 80 per cent power factor motor in no way impairs the ability of the motor to carry overload, since overload will result in an increased rise in the armature.

With the field excitation held constant, the increased load is accompanied by a reduction in reactive capacity and a gradual increase in armature current. An 80 per cent power factor motor with a 40 deg. C. stator will carry about 140 per cent overload, the power factor at this load being approximately unity and the temperature about 50 deg. C. throughout. An 80 per cent power factor motor with both field and stator designed for 40 deg. C. normal operation would be more expensive, because of the increased size of the field, and would carry little if any more overload than the motor with the 50 deg. C. field, since the stator would again reach its maximum safe operating temperature at about 140 per cent overload.

Motors with high-starting, pull-in and pull-out torques generally have lower efficiency at part loads than low torque motors, because below full load the constant losses (core loss, friction and windage, etc.) resulting from the necessary larger frames are greater in proportion to the variable (copper) losses. The actual load conditions should therefore be determined as closely as possible to obtain motors having the maximum operating efficiency.



An 1,800-Hp. Motor Direct Connected to a Piercing Mill in a Seamless Tube Plant

Classes of Applications

The machines to which synchronous motors are usually applied can be divided into three general classifications:

First—Machines such as compressors, jordans, pulp grinders, etc., that permit at least partial unloading during starting. Motors for these applications, therefore, usually have relatively low starting and pull-in torques ranging from 30 to 50 per cent for the former and from 30 to 40 per cent for the latter, and since the load for these applications is generally uniform, 140 to 150 per cent pull-out torque is, in most cases, ample.

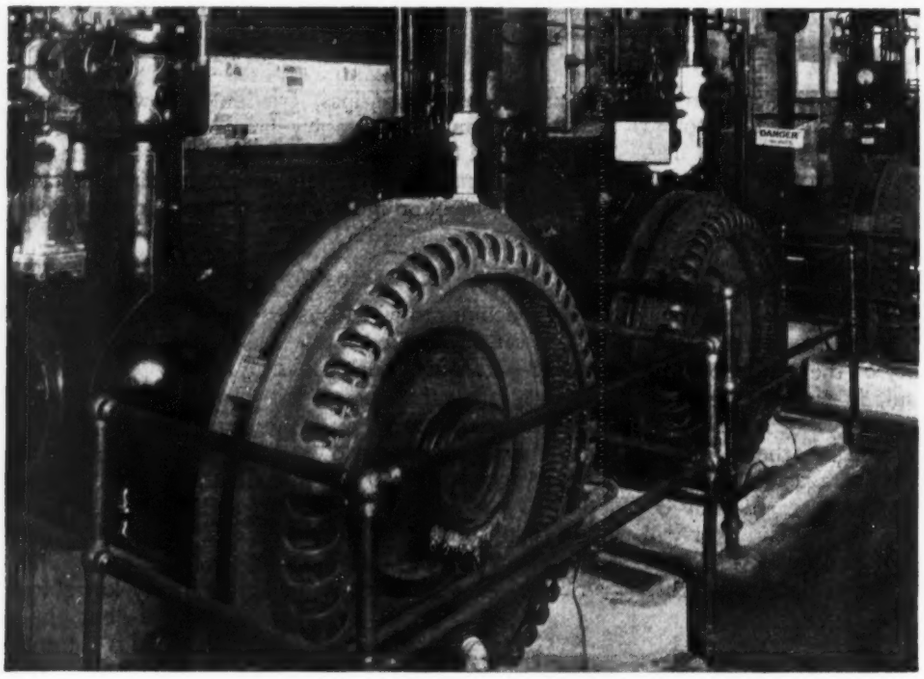
Second—Applications requiring relatively low starting torques but high pull-in torques. These machines are usually of the centrifugal type, such as pumps or fans, and on this type of equipment the starting load is only that resulting from friction and inertia and consequently low starting torque can be used. Modern practice is to equip most fans and pumps with automatically operated discharge valves so that the pump or fan is connected to the system at about the time it reaches full speed conditions. This, of course, necessitates that the motor must develop full-load torque at pull-in. Pull-out

torque can be relatively low, however, since here again the load is usually uniform.

Third—Those applications requiring high starting and pull-in torque, as tube mills, ball mills, metal rolling mills, wood hogs and shippers, band saws, crushers, rubber mills, line shafts and many others. No general torque specifications for this class can be made, since each application presents its own problem.

As much thought should be given to the selection of auxiliary (exciting and control) equipment as is given to the selection of the motor. If the speed of the motor is fairly high, say 600 r.p.m. or above, individual direct-connected exciters usually offer the least expensive form of obtaining exciting current, especially if relatively few motors are being installed. At speeds below 600 r.p.m., however, the cost of direct-connected exciters begins to mount rapidly, and it will generally be found that more economical exciting equipment can be selected. This may be either a belted exciter or a small induction motor-generator set. Belted exciters, when the cost of the driving pulley, belt, etc., is added, may be more expensive than either a direct-connected exciter or a motor-generator set. Using either a belted exciter or motor-generator set may run up installation cost, unless the control can be located very close to the motor, since the exciter circuit must be run to the control panel, then returned to the motor. Motor-generator sets for excitation are rapidly gaining favor. Modern synchronous motors require relatively low excitation, so that small, inexpensive sets may be used. Also, they can be installed near the control panel at any distance from the motor, making for lower installation cost. When two or more motors are used, one motor-generator set large enough to furnish excitation for all motors can be used. Many times two such sets (one a spare) can be bought at about the same price as the sum of the individual exciters. This makes a very flexible installation. A failure of an individual exciter takes the entire unit out of production. With a spare motor-generator set a failure in one set causes little inconvenience and only a short delay while the other set is being put in operation. Other combinations, such as three sets each having a capacity of one-half the total requirement, may be found the most economical.

Of course, if direct current is already available in sufficient quantity and can be economically brought to the location of the synchronous motor it should be used. Some sort of resistance must be used with such installations, to compensate for any difference between the distribution voltage and the voltage required at the motor collector rings. This may be either a rheostat or fixed resistance with taps. Except when adjustment of the power factor is anticipated, requiring variation of exciting current, or when the direct-current voltage is irregular, the latter will be found just as satisfactory and costs less.



Low-Speed Synchronous Motors Driving Ice Machines in an Ice and Cold Storage Plant

Control equipment has undergone the same development as synchronous motors. Modern push-button (or other master switch) operated control of either full or reduced voltage type makes the starting of a synchronous motor as easy as starting a washing machine. Practice is generally to start all synchronous motors on full line voltage. If the application requires high starting torque full voltage starting will be necessary. No reduction in starting kva. will be obtained by using a motor with, say, twice the starting torque required to start the load and starting it at reduced voltage, since the kva. required to produce the torque will be about the same, i.e., the torque per kva. will remain approximately constant. Full-voltage starters are, of course, less costly than reduced voltage of either the manual or magnetic type.

Before making the final selection of the motor a number of other factors must be considered. A decision must be reached as to whether a high-speed belted or geared unit should be installed rather than a direct-connected motor. In making this decision, first cost, performance, floor space, upkeep, etc., must be balanced. A selection must be made between synchronous and induction motors. Here again the same factors must be considered, first cost, performance, floor space, etc., together with cost of control and also whether the induction motor will result in increased power cost.

If the balance is in favor of the synchronous motor another question must be decided. Shall the motor be 100 per cent or 80 per cent? The former may possibly be lower in first cost, but the latter may lower operating cost, especially if the power company offers a premium for high power factor. Even though no preferential power rate can be obtained, improvement in the plant

power factor may be desirable, as a means of obtaining better voltage regulation and hence improved operation of other apparatus.

Letters from Our Readers

Large Units Not Always Most Economical

To the Editor of the ELECTRICAL WORLD:

Evidence seems to warrant the editorial in the October 26 issue of the ELECTRICAL WORLD regarding "Cost Specialists Needed."

A mill in one of the Southern states used 1,150 sec.-ft. of water under 23-ft. head, but obtained only 1,500 hp. from this power. When the owners realized that 1,150 sec.-ft. under 23-ft. head would develop only 3,010 hp. theoretically, they recognized that their wheels were less than 50 per cent efficient and hired an engineer of unquestioned ability to lay out plans for a new plant or rehabilitate the old one. This engineer analyzed the situation, but did not investigate sufficiently what some other combinations might do or how costs could be reduced. Two schemes were suggested, but both of them contemplated entirely new plants, each with three new modern waterwheel units in entirely new settings. The dam was to be raised and the tailrace cleaned out to get added storage and increase the head to 27 ft. While the engineer showed he could get a maximum of 3,545 hp. through use of regulated stream flow from storage, still the cost of making this development was approximately $340,000—so high that the mill hesitated to go ahead.

The task of analysis was assigned to a "cost specialist" and designing engineer. This specialist used the same basis of costs so as to permit comparisons, but he found that it was not at all necessary to scrap all of the present structures, as had been suggested. He also found that by using smaller units, four of them would give greater water economy and develop more horsepower at a great saving in total cost.

Designing engineers base their findings on study of load factors and largest size units that fit stream flow best, whereas if they had sufficient data on hand to see what some smaller size or other combinations might do the costs might be greatly reduced and economy increased. Here is where the value of a cost specialist comes in.

This brings me to another concrete case that very nearly proves that selection of very large power units is in some cases a fad and not as economical as it would have been to use smaller size units and a number of them.

A hydro-electric plant was recently built and then accurately tested. The results were brought to the attention of a "cost specialist" and designer, because this plant was rather boasted about as having the largest single unit ever made for such a low head. The costs were not available, but a comparative study indicated that this development would have cost less and been more economical in every way if the units had been just half the size and consequently of greater speed.

The plant, as built, had an over-all waterwheel efficiency of 80.4 per cent and a generator efficiency of 92.1 per cent compared with a two-unit over-all waterwheel efficiency of 83.4 per cent and a generator efficiency of 92.6 per cent, giving an over-all gain by the use of two units of 3.8 per cent.

The differences in cost are indicated below:

	Large Single Unit	Two Smaller Units (Equal Hp.)
Width of penstocks (ft.)	43	26
Length of penstocks (ft.)	43	26
Depth of excavations from flange of wheel (ft.)	42	24
Total length of house × total width of house (sq.ft.)	1,849	1,352
Excavation.—Width × length × depth (cu.ft.)	78,078	32,448

Excavation is the main item of difference in favor of a multiple of smaller units. The cost of the equipment shows that the two smaller wheel units cost more per pound, but the weight per horsepower of the large unit is very much more, so the total cost of waterwheels is less where the two smaller units are used. The cost of generators shows that one large unit is slightly less than two smaller sizes, but not near enough to wipe out the difference in favor of smaller waterwheels.

In this case I think it may well be asked, Was it a fad of the designer to make this plant one that had the largest single unit under such a low head?

I do not claim that all plants would figure out cheaper if smaller units were used, but I do claim that designing engineers do not give them enough consideration in trying to reduce costs or increase economy, nor do they avail themselves of data that the manufacturers can give them if they will take advantage of it.

H. H. WHITE,
Sales Engineer

James Deffel & Company,
Atlanta, Ga.

Uses Simple Controls for Auxiliary Drives

To the Editor of the ELECTRICAL WORLD:

In the Nov. 9 issue of the ELECTRICAL WORLD there is an article by M. M. Samuels in which he suggests a system of auxiliary supply eliminating automatic switches on the individual motors, using a group switch for protection in case of failure of a motor or its leads.

It may be of interest to your readers to know that essentially this method has been used by us for a number of years, notably at the Edgar station of the Edison Electric Illuminating Company of Boston. At this station the switch at the motor is an inexpensive non-automatic, hand-operated oil circuit breaker. This applies to the 550-volt as well as to the 2,300-volt motors.

M. J. LOWENBERG,
Electrical Engineer.

Stone & Webster Engineering Corporation,
Boston, Mass.

Summary of Two Reports

	Continuous Flow, (Sec.Ft.)		Regulated Flow 56 Hours per Week. (Turbine Discharge in Sec.Ft.		Equivalent Hp. Based on 56 Hours per Week		Total Cost	Cost per Hp.
	Min.	Aver.	Min.	Aver.	Min.	Aver.		
First engineer's report	380	600	1,040	1,500	2,640	3,545	$336,000	$94.75
Second engineer's report	380	600	1,040	1,500	2,670	3,580	265,000	74.00
Increase in power and actual saving					30	35	$71,000	$20.75

Digest of Foreign Literature

Hydro-Electric Development and Steam Equipment

Hams Hall Station.—The initial section of the new electricity generating station of the city of Birmingham, England, has a plant capacity of 60,000 kw., is equipped for pulverized fuel firing of the unit system and is expected to have an over-all theoretical efficiency of 23.3 per cent. This new station, which will ultimately be a base-load station for the national electricity scheme in England, differs from standard practice in a number of respects, the outstanding points being the use of a generating frequency of 25 cycles, the adaptation of the unit system of pulverized fuel firing in the face of a number of successful bin storage systems in England, the inclusion of large cooling towers for the circulating water, and transformers of unusually high efficiency. While the completed station, with a plant capacity of 210,000 kw., is expected to represent a capital expenditure of about $75 per kilowatt of main plant installed, the capital cost of the present section is approximately $115 per kilowatt. Engineering features and plant layouts are indicated.—*Electrical Review (England)*, November 8, 1929.

Generation, Control, Switching and Protection

Testing of Large Rotary. — H. MÜLLER and FR. EMMERICH. A Swiss concern recently constructed a large rotary converter to change 11,000 volts, 25 cycles into 240 volts direct current. The machine is rated 4,200 kw. at 14,800 amp., allowing a two-hour overload with 22,000 amp., or 45,000 amp. for a short duration. With a speed of 167 r.p.m. an eighteen-pole inductor and 1,650 to 5,000-amp. per brush bolt, this rotary was the largest one ever built in Europe, having a total weight of 58 tons. The results of tests are indicated. At full load the machine has an efficiency of 95.2 per cent rising to 95.4 per cent at 50 per cent overload and dropping to 89.9 per cent at quarter load. — *Brown, Boveri Mitteilungen*, November, 1929.

Circuit Breaker Tests. — C. CIPPITELLI and O. SCHWENK. Circuit breakers are nowadays bought primarily upon their ability to open safely a certain amount of kva. This rupturing capacity is either tested at the manufacturer's short-circuit test equipment or in the field. While such tests are excellently suited as a final criterion for the suitability of a certain breaker, and as a comparison between competing breakers, they do not help the designer to improve the construction in case of a fault. A breaker may fail, for example, before its contacts actually open. The authors believe that a test on breakers with very high current at very small voltage gives much more valuable data. A transformer of 1,250 kva. with a secondary for 12½ volts and 100,000 amp. is described in the article, which is used to good advantage for the study of breaker contacts in air and in oil. Effects of welding, chattering and electrodynamic forces, particularly those tending to blow the contacts apart, can be readily studied with the aid of such a high current transformer. A more general use of such tests on modern breakers is advocated by the authors, who believe that a mere short circuit closing or opening test is inadequate.—*Elektrotechnische Zeitschrift*, October 24, 1929.

Transmission, Substations and Distribution

Field Tests with the Impedance Relay.—H. KYSER.—On the complex 50-kv. transmission system of Thyringia (Germany), covering a total distance of 150 miles, with several loops and interconnections to other 100-kv. systems, a large number of impedance relays are used for the selective protection of its various sections. To establish the satisfactory performance of these instruments under the most adverse fault conditions extensive field tests were made last year. Power supply for these tests was furnished by three generators of 1,200, 12,600 and 25,000 kva., located near the two extremes of the system. The tests comprised nineteen two- and three-phase metallic short circuits and fourteen two-phase and three-phase arcing short circuits. The results are tabulated, with typical oscillograms and photographs to illustrate some of the faults. The tests indicated that these relays will cause but few incorrect line openings, that their action is exceedingly prompt, and that the power factor in the faulty link has no effect upon their proper action. — *Siemens Zeitschrift*, October, 1929.

Single-Phase Load on Three-Phase Transformer. — M. DOURIAU. What appears to be a novel method of deriving single-phase load from a three-phase transformer without causing appreciable unbalance on the three-phase side is described in this paper. According to this method two small auto-transformers of the ratio 2 to 1 are connected one across the phase voltage, the other across the leg voltage of the Y-secondary of a three-phase transformer. The single-phase load can then be connected between the two mid-points of the auto-transformers. By means of circuit and vector diagrams the author proves the soundness of this proposed arrangement. It is stated that for currents and energies, such as are commonly used on welding machines and projection lanterns, the method causes no noticeable unbalance of the three-phase supply. — *Revue Générale de l'Electricité*, October 26, 1929.

Units, Measurements and Instruments

Measurement of Stream Velocity by Air Bubbles.—OTOGORO MIYAGI.—As air bubbles rise in still water with their respective constant terminal velocities as soon as they have started from nozzles, this having been verified by previous investigations by the author, it has been found to be true that in the case of flowing water the displacement with which the bubble is carried downstream with the water is proportional to the mean velocity of the stream. This has led the writer to consider the possibility of making use of air bubbles for measuring the mean velocity of flowing water, especially to measure such a low velocity that scarcely any current meters can be used for measuring. As a result of a careful research a method of determining the sizes of bubbles best suited for such an investigation has been developed, as have the general procedures found adaptable for this work. —Vol. VIII, No. 4, *Technology Reports of the Tohoku Imperial University (Japan)*, 1929.

Precision Permeability Measurements on Straight Bars and Strips in the Region of High Permeability.—C. B. WEBB and L. H. FORD. — Utilizing a yoke apparatus to give high magnetizing forces the authors have conducted a series of investigations for measuring permeability in straight bars and strips. Sheet material samples consisting of a large number of strips, if mounted in a yoke parallel to the base of the clamp, are liable to considerable errors from the effect of the reluctance between the strips. A number of specific suggestions to avoid difficulties and insure accuracy in the measurement of permeability have been made.—*Journal of the Institution of Electrical Engineers (England)*, November, 1929.

Illumination

Series Street Lamps.—L. BLOCH and E. FRIEDRICH. The illumination of streets by a high-voltage series of incandescent lamps is almost unknown in Europe. It has been found that electric light of low candlepower is only economical if low-voltage filaments are used. Consequently a special 24-volt, 150-watt lamp was developed, and nine of these lamps were connected in series on the customary 220-volt supply system. To avoid outages, each of these lamps

has a second lamp in parallel, but this second bulb is in series with a small set of lead-copper oxide plates. With the main lamp burning only 24 volts is impressed across the lead-copper oxide plates, which completely blocks this potential. If the main lamp burns out the 220 volts across the plates will break them down, causing the emergency lamp to light. This inexpensive method is judged to be superior to the American film cut-out.—*Elektrotechnische Zeitschrift*, October 31, 1929.

Heat Applications and Material Handling

Electric Warming.—R. GRIERSON.—According to the author, the advantages of a well-designed modern continuous electric warming system are: Its entire invisibility in the decorated room; its adjustable automatic temperature control; its low operating temperature, and its perfect reproduction of the atmospheric conditions of the most desirable days of early summer. In reviewing the better known types of electric heating media such as unit heaters, resistance wire convectors, electrically heated hot water heaters, pipe heaters, plate heaters, thermal storage systems, and panel system, a new warming device is described. While this is still in the course of development it embodies a ⅜-in. thick smooth plaster board incorporating the element. This is intended for direct attachment to existing ceilings where the projection of the standard type might be considered an objection. Cork insulation is fitted between the floor joists. Standard panels are designed for a maximum surface temperature of 120/125 deg. F. when fixed horizontally on a ceiling and operated in still air. Under automatic temperature control, the temperature, providing adequate surface is installed, in relation to the heat loss averages 85/90 deg. F. even on cold days. Loading averages 40 watts per square foot of active surface, or 400 watts for the standard 6-ft. x 2-ft. or 4-ft. x 3-ft. panel. These low temperatures involve extended surfaces which are inevitably more costly than small high temperature sources of heat, but records clearly prove that such initial costs are, according to the author, quickly offset by the lower operating costs.—*Electrician (England)*, November 15, 1929.

Miscellaneous

Copper Covered Steel Wire. — G. DETTMAR.—Under the name of "KPS" (copper armored steel) a bimetallic solid conductor is being marketed in Europe, which the author believes deserves a great deal more attention than it has hitherto enjoyed. Unlike other, previously offered, bimetallic wires, the KPS material represents an intimate cohesion between the steel core and the outer copper skin. The raw steel billet, while red hot, is covered with a thick copper jacket under vacuum and high pressure, insuring a perfect contact between the two metals and excluding all air pockets. Subsequent rolling to the final diameter, twisting or sharp bending causes in no case a flaking off of the copper skin. Depending upon the diameter, the conductivity of KPS wires is from 20 to 35 per cent of that of the same solid copper wire, while the tensile strength is between 92,000 and 99,000 lb. per square inch. This unusual strength is not noticeably impaired for temperatures up to 300 deg. C. The wire is suitable for short transmission, long spans, trolley span wires, trolley overhead wires, lightning cables, telephone lines and resistors. Cheapness, great strength and the non-rusting feature are the chief advantages of this material.—*Elektrotechnische Zeitschrift*, October 31, 1929.

Book Reviews

Transmission Networks and Wave Filters

By T. E. Shea, B.S., M.S. New York: D. Van Nostrand & Company. 470 pages, 262 illustrations. Price, $6.50.

This book is the latest of a group of treatises written by members of the technical staff of the Bell Telephone Laboratories. The material it contains has been used for several years in a series of lectures given for the benefit of other employees of the Bell Telephone Laboratories and has also been presented at the Massachusetts Institute of Technology. The author is especially well fitted for his task by reason of his natural ability, his early training and several years of responsible work in the Bell Telephone Laboratories.

Though the title of this book mentions transmission networks and wave filters, it treats exhaustively only the types of networks which are properly to be called filters. The treatment is necessarily highly mathematical, but the "practical" aspect of the subject is not omitted.

The contents of the book are divided into an introduction and three major parts. The introduction discusses in a general manner the uses and properties of transmission networks and illustrates this use by describing a telephone carrier system. Part I states and explains a number of definitions and theorems, a knowledge of which is important to the understanding of the remainder of the book. In this section are also described a number of general properties of transmission networks and of the impedance arms of which such networks are composed. In Part II the detailed discussion of many important types of wave filters is taken up. In Part III the representation of periodic waves by Fourier's series and the representation of transient waves by Fourier's integral are explained.

This book should be of value to engineers who have to deal with the application of filters to practical problems and to teachers and students of electrical circuit theory and practice. For those who are interested in the broader aspects of electrical wave transmission but who may not have the time or inclination to read the entire book, the material contained in the introduction and in Parts I and III should be interesting and instructive.

A complete list of the symbols used in the book and an index are provided which add to its convenience and usefulness as a reference text.

Market Data Handbook of United States

The United States Department of Commerce, through the Bureau of Foreign and Domestic Commerce, has just published a handbook that ought to prove exceedingly useful for the making of market studies either locally or on a nationwide scale.

The title is too modest. It suggests something that might go into one's coat pocket, whereas a brief case is none too large. The book contains 533 pages, 9 x 11½ in. in size. After an introduction briefly discussing the sources of the statistics quoted and an extensive bibliography showing where further information may be obtained, there follows a mass of data on each of the 3,073 counties in the United States occupying nearly 200 pages.

This portion of the book presents the market in six aspects: The general consumer market, the production of fisheries, number of telephones by states, central electric light and power stations and number of customers by classes, the farm market and the industrial market. To list the many items under each would require more space than is here available. Next come industry statistics for all cities having 10,000 inhabitants or more, arranged by states.

The remainder of the book is largely devoted to a detailed presentation of the number of various kinds of industries in each individual county. A checkerboard arrangement makes it very easy to find information.

To assist those organizations which have not already worked out trading areas and to furnish a check to those who have already done so, four large trading-area maps are included as supplements to the handbook.

The foreword states that in addition to its primary purpose the book will undoubtedly be of value for general reference, since it contains the most comprehensive compilation of statistical data for counties that has ever been assembled. The latter assertion appears to be abundantly justified. It is safe to predict a large call for the volume from alert merchandising organizations.

News of the Industry

Municipal Ownership Defeat in Cambridge, Mass.

Municipal ownership of the electric lighting system of Cambridge, Mass., was defeated on Tuesday evening by the failure of the City Council to muster the necessary two-thirds vote to turn the issue over to the electorate at the next city election. Eight councilors favored and seven opposed a popular referendum on the subject. This is the second time within a fortnight that a Massachusetts city has set its face against embarking on the municipal ownership of central stations, with all the political implications involved, and the threat to the tax rate embodied in these proposals has been a strong element in arousing public sentiment against them.

No Independent Power Board Likely to Be Formed

It is not believed that President Hoover's recommendation for the appointment of full-time members of the Federal Power Commission means that an independent agency is to be set up. Unless the water-power act is amended, all work must be done by and through the War, Interior and Agricultural Departments. The whole conception of the water-power act was simply to provide a single agency in which the water-power responsibilities of the three departments could be co-ordinated. No centralized and independent establishment can be built up, it is believed, without conflict with the act and without changes in the fundamental responsibilities vested in the three departments.

Without far-reaching changes, the full-time commissioners would have to be the representatives of the three departments. To comply with the President's suggestion an assistant secretaryship could be authorized for the purpose. An alternate possibility is the detail of three engineers, from the Corps of Engineers, the Bureau of Reclamation and the Forest Service respectively, to serve as members of the commission.

Illinois Commission Opposes Couzens Bill

The Illinois Commerce Commission has just adopted a resolution in opposition to the passage of Senator Couzens' bill for the establishment of a federal commission with regulatory jurisdiction over interstate power and communication. The Illinois commission thus brings itself in line with numerous other state commissions which have passed similar resolutions. These include Indiana, Kentucky, Connecticut, Maine, Colorado, Washington, Arizona, New Mexico, Montana, North Dakota and Louisiana.

Upper Colorado States Again Confer and Protest

A conference of representatives of Colorado, Wyoming, Utah and New Mexico on the question of allocation of water in the upper Colorado River basin, held on December 3 at Denver, was confined to informal discussion because there was no representative of the federal government in attendance. Each of the states was represented by its interstate water commissioner, its state engineer and their technical advisers. These men attempted to decide on a uniform method of determining irrigable acreage, stream flow and other technical problems, so that when each state makes its definite claims at a later conference all data will be in the same terms.

In the meantime, the conference decided, Arizona will be invited to attend the adjourned meeting, at which the federal representative will become permanent chairman. A portion of the Colorado River above Lee's Ferry, the dividing point between the upper and lower basins, flows through Arizona, so the conference felt that state should be invited to attend. Under the Santa Fe compact the upper states must deliver at Lee's Ferry 75,000,000 acre-feet of water over a period of ten years. This leaves approximately, for the upper basin, an annual consumptive use of 7,500,000 acre-feet of water.

A strong protest was signed by the conferees at Denver and forwarded to Washington against the power and water-storage rates proposed by Secretary Wilbur as unduly favoring south California.

McCarter Announces Another Rate Reduction

Thomas N. McCarter, president of the Public Service Gas & Electric Company, in a letter sent from Newark this week to the New Jersey Board of Public Utility Commissioners, announces a reduction in the company's rates for electricity, effective January 1, that, he says, will result in a total saving to consumers of $1,300,000 a year. The action was in response to the commission's request that a reduction of "not less than $1,000,000" be made.

Distribution of the cut was not stated in the letter, but it is expected that it will effect a further reduction in the present special residential rate of 5 cents a kilowatt-hour for consumption over the first 50 kw.-hr. a month. The present rate of 9 cents for the first 20 kw.-hr. and 8 cents for the next 30 kw.-hr. is not expected to be altered.

Rain Relieves Northwest Situation

Tacoma Benefits by Heavy Fall in Nisqually Watershed—Seattle Experiencing No Stringency—Oregon Companies Report Rise of Clackamas, White, Salmon and Hood

RAIN has been falling since Sunday night, December 8, in western Washington and the Northwest States generally, and as a consequence some alleviation of the water-power situation there has come. Temporary relief for Tacoma's municipal system was felt on Tuesday owing to continued heavy rains in the lower Nisqually River watershed, and the La Grande plant was reported up to full capacity—32,000 hp. Conditions at Lake Cushman, Tacoma's hydro plant in the Olympic Mountain range, have not changed because the precipitation was in the form of snow.

The municipal plant situation in Seattle, officials report, is virtually the same as last week. It has never been acute, 70 per cent of the lighting department's load having been carried by steam plants. Additional rainfall predicted by the local weather bureau will be a great aid, unless freezing sets in.

R. M. Boykin, Puget Sound Power & Light Company, says that 60 per cent of that utility's normal load has been carried by steam and 40 per cent by water, these proportions being reversed for the peaks. The company's hydro plants at Electron and Snoqualmie are carrying full load, and the reservoirs at Lake Tapps and Lake Shannon have risen substantially.

In the Portland (Ore.) area, where 3.85 in. of rain has lately fallen, the Clackamas River and its tributaries have risen sufficiently to permit the Portland Electric Power Company to resume almost normal hydro generation, which customarily at this time of year takes care of 80 per cent of its load. An equally generous rainfall in the White, Salmon and Hood River watersheds has raised the hydro output of the Northwestern Electric Company to double what it was a week ago.

California Utilities Do Not Fear Power Shortage

Despite Drought, the Three Big Northern Companies Are Doing Business as Usual, While Southern California Edison Is Completely Fortified.

ALTHOUGH the State of California is confronted with a serious water shortage, the four principal power companies—the Pacific Gas & Electric, Great Western Power, San Joaquin Light & Power and Southern California Edison—are facing the situation with confidence.

The lack of rain and of snowfall in the mountains has greatly reduced the output of the hydro plants on the Pacific Gas & Electric Company's system, but as the water has dropped off, it has been replaced with steam, and at the beginning of December about half of the entire load was being carried by the company's steam stations, of which there are four, two in San Francisco, one in Oakland and one in Sacramento.

The ability of the Great Western Power Company and the San Joaquin Light & Power Corporation, which serve northern and central California, to meet power demands upon their systems is assured by their steam plants and interconnected systems.

The Southern California Edison Company reports that the prevailing drought conditions will in no way curtail its power supply. By taking advantage of abundant and low-priced natural gas, which has been used as fuel in its steam plants, the company has conserved water in its storage reservoirs, and its steam plants have a capacity of 490,000 hp.

These facts are attested respectively by P. M. Downing, A. E. Wishon and R. H. Ballard, executives of the companies named.

Federal Trade Board Asks More Power

Cites Electric Bond & Share Resistance as Proof that Congress Should Clarify Commission's Right of Subpœna and Requisition

CITING the public utility investigation as one of the inquiries directed by Congress in which it has been hampered by the doubtful status of its power to subpœna witnesses and to compel production of books and papers, the Federal Trade Commission in its report to Congress asks a specific delegation of such authority. In its recommendation the commission refers to the decision of Judge Knox in the Electric Bond & Share case. Judge Knox, on application of the commission to require that company to submit its operating expense ledgers for inspection and to give testimony, held last July that the commission has power of subpœna in a general investigation and that witnesses must answer pertinent questions, but that it has not yet established probable cause that the papers called for contained relevant evidence.

Declaring that such an amendment as that asked would remove much of the difficulty which the commission has encountered in carrying on investigations directed by Congress, the commission's report continues:

A specific delegation of such power, limited to the general scope of matters now committed to the commission by its organic act and to be exercised only upon the direction of either house of Congress, would greatly facilitate the work of the commission in conducting the general business inquiries which have been frequently directed by either the Senate or House of Representatives. Senate Resolution No. 83, in some of its phases, is such an inquiry and specifically calls for recommendations as to needed legislation.

Young Declares for Wire and Radio Monopoly

Chairman of Radio Corporation Expresses Also His Personal Preference for Actual Investment Over Reproduction Cost New as Rate Base

SPEAKING more in the manner of a businss statesman than as a director of more corporations than he could think of offhand, Owen D. Young frankly let the Senate interstate commerce committee know at a hearing on the Couzens bill held on Monday that he favors monopolistic control of facilities for transmitting record communications by wire or wireless. He recommended monopoly direction under government regulation as preferable, but he asserted that if not otherwise attainable, it should be under government ownership. The chairman of the Radio Corporation and General Electric Company boards declared it his opinion that monopoly control of external or transoceanic communication services by cable and wireless is essential to the safeguarding of the national interest.

He was not clear as to how international communication services could be regulated by the government in the manner of purely internal services of that kind, but he thought that with a single company to deal with a method of adequate regulation could be developed. He told the committee of the arrangement the Radio Corporation has made with the International Telephone & Telegraph Company for unifying the cable and wireless communication facilities of both companies. The arrangement is dependent on a change in federal law.

In another part of his testimony Mr. Young told the committee that rates fixed by government regulating bodies for public utility companies should be based on actual investments made in good faith in property used or useful in performing the services for which the regulated charges are made. He thought the actual-investment basis preferable to the alternative reproduction-cost basis.

The committee on interstate commerce has agreed to a favorable report on the bill of Senator Dill of Washington extending the life and powers of the Federal Radio Commission "until such time as is otherwise provided by law."

O. D. Young to Head Business Survey Committee

O. D. Young heads the list of the executive committee of the National Business Survey Conference announced on Thursday by Julius H. Barnes, chairman. This list includes Thomas W. Lamont, Clarence Woolley, Walter C. Teagle and sixteen other nationally known executives.

Non-Export Vote Accepted by Maine Power Companies

President Walter S. Wyman of the Central Maine Power Company and the New England Public Service Company of Maine, addressing the Grangers at Augusta, Me., on December 4, made a statement which implies that these companies have given up their efforts to have the Fernald law prohibiting the exportation of electric power changed. He said:

"We shall initiate no further effort to have this law changed by the Legislature or by the people. It was definitely decided September 9, after a long campaign of education and information, and, as far as we are concerned, it is settled."

New Orleans to Be Tied in with Southwest System

Rights-of-way have been obtained and work is beginning on a 110-kv. transmission line from Roseland, in Tangipahoa Parish, La., to New Orleans. An expenditure in excess of $1,000,000 is involved in the construction, which will be completed by next August.

Roseland is at present the southern terminus of the high-tension system of the Louisiana Power & Light Company and the Mississippi Power & Light Company radiating from the large steam power plant at Sterlington, in the north Louisiana gas fields. The line runs east from Sterlington, crossing the Mississippi River at Vicksburg, and follows the Illinois Central south from Jackson.

The extension of the line to New Orleans will come southward through Hammond and Ponchatoula, thence strike across through the swamps to Sorrento, and follow the Louisiana & Arkansas Railway down to the Bonnet Carre spillway site, where it will cross the Mississippi River. It will then follow the west bank of the river down to Gretna, where transformers will step the current down to 13,200 volts. Six cables will be laid across the river at Gretna to bring the lines to the Market Street station of New Orleans Public Service Inc. Under ordinary operating conditions the local power plant will feed into the system, furnishing up to 30,000 kw. for consumption in southeast Louisiana and southern Mississippi.

Commission and Utilities Both Under Fire

Witnesses Tell New York Investigators That Regulators Protect Companies—Consolidated Gas Merger Said to Include $200,000,000 of Water in Capitalization

A SHARP attack on the New York Public Service Commission as the alleged protector of the utility companies, made by E. F. Jeffe, said to represent ten thousand industrial users of electricity, was made at the resumed sessions of the legislative investigating commission inquiring into the New York Public Service Commission law last week. He accused the commission of unnecessary delays, undue secrecy, unwillingness to aid consumers and a disposition to give the utilities the advantage of legal technicalities. The great need of the public, he said, was a representative on the commission to serve as its legal adviser.

Percival R. Moses, engineer, advocated a new electrical rate structure to reduce the differential between retail and wholesale rates and thus eliminate the inducement to large building owners to submeter.

At a later hearing the relationship of utility companies to affiliated engineering firms was taken up, in connection with the Long Island Lighting Company and E. L. Phillips & Company. The records of the lighting company disclosed, an accountant for the investigating commission said, that during the whole of 1928 the Phillips company owed the utility an average of $2,500,000 and paid no interest upon it. This continuing debt represented excess payments made by the utility to the engineering company for construction, repair and commercial services.

In adducing this testimony, Colonel William J. Donovan, counsel for the investigators, brought out that the Public Service Commission has no jurisdiction over engineering affiliates of utilities, and their books are not open to inspection. A letter from E. L. Phillips, president of the Long Island Lighting Company, stated that profits from engineering fees, etc., on work done for public utilities did not amount to 4.08 per cent.

Hearings were continued on Monday and Tuesday of this week. Daniel De V. Harned, vice-president and attorney for the Community Councils of New York City, directly attacked William A. Prendergast, chairman of the Public Service Commission, as an exponent of the "utility corporation viewpoint" and arraigned both him and the commission for "rushing" their approval of the merger in 1928 of the Brooklyn Edison Company with the Consolidated Gas Company. The consolidation, he maintained, was overcapitalized by more than $200,000,000, of which $44,100,000 was "water" due to excessive exchange value allowed for Brooklyn Edison stock.

Mr. Harned declared that 5 cents a kilowatt-hour would be the maximum rate for electricity warranted in New York City. He made many recommendations on behalf of the 48 local councils for which he spoke. These included indorsement of the Massachusetts commission's method of valuation.

Leland Olds, an economist, told of a report prepared for the City Club bearing out the allegations of watered stock in the capitalization of the merged utilities of Greater New York. This report, he said, had been made ready for circulation and then withdrawn on the intervention of the Consolidated Gas Company. Informed of Mr. Olds' testimony, Richard S. Childs, president of the City Club, said that the report in question had been withheld because the company had asked for time in which to make a detailed reply. For this reply the club is still waiting, he said.

William L. Ransom, counsel for the company, said the charges were "old stuff" and had been discredited in court hearings. He also denied allegations, made by Mr. Harned, of collusion with coal companies to maintain the surcharge. The company is waiting its turn before the commission to answer all charges brought against it.

On Wednesday the investigating commission went into executive session to hear charges preferred against members of the Public Service Commission by Mr. Harned. These were rumored to have been of a more specific nature than anything in his public testimony, but no information concerning them was given out.

Utility Men Sketch Pleasing Picture in Bay State

Full co-operation by the Massachusetts Gas and Electric Association was pledged by its president, Charles L. Edgar, in connection with the current legislative inquiry into public utility affairs at a hearing in Boston last week. Sheldon E. Wardwell, counsel for the association, gave the special committee sitting at the State House an exhaustive survey of the growth and purposes of the electric utilities of the Bay State during the past decade. He pointed out that the question of the so-called prudent investment versus the reproduction-cost rate base is fast becoming of academic interest in view of the physical expansion of utility properties at prevailing price levels of labor and material. The speaker depicted a healthy power industry in the Bay State rendering an increasingly excellent service at diminishing rates to the public.

A convincing and straightforward account of the benefits of the holding company was given the committee by W. Rodman Peabody, vice-president Western Massachusetts Companies.

In reply to inquiries by committee members as to the probable trend of mergers in the electrical industry, Mr. Peabody declared that further developments along this line are anticipated in New England, and that in their consummation very little attention is likely to be paid to state lines. Local representation, the speaker averred, should be well maintained in such groupings in the interest of administration in closer accord with local needs. Federal regulation, the speaker thought, would be very undesirable under the present outlook, and Mr. Peabody said that in his opinion the clause lately adopted by power companies submitting interstate power contracts voluntarily to the regulation of state commissions on each side of the line would take care of all exigencies in this sort of development.

Commission Soft-Pedals the Boston Edison Inquisition

Unwillingness on the part of the commission to require the Boston Edison company to meet needlessly elaborate questionings on the part of its opponents in the pending rate case marked the last full hearing before the Department of Public Utilities at Boston. Nearly three score interrogatories were presented in the case by W. C. Marshall of Watertown, and while the company announced its willingness to answer many of these, it was brought out that not a few of the inquiries had no bearing upon the reasonableness of the company's rates and that in other instances the company's system of accounting required by the commission makes it impossible to segregate numerous items in its cost structure.

Chairman Attwill repeatedly ruled that the minute questions leveled at the company by Mr. Marshall would, if answered, throw little light for the board upon the equity of the rates, and in general the company was directed to furnish answers which might be reasonably practicable of determination. It was brought out that no private power sales contracts exist on the Boston system and that the publication of details of coal contracts might injure the dealer and impair negotiations for future fuel supply. The next hearing has been set for December 18.

Wide Gap Between Valuations of Portland Electric Power

Further submissions of exhibits and testimony concerning the valuation of the Portland Electric Power Company consumed the single day's session of the reconvened hearing before the Oregon Public Service Commission in Portland on December 2. J. A. Rockwood, testifying for the company, showed its total valuation for rate-making purposes to be about $71,000,000, including street-railway property. The commission's engineers had set the valuation at $69,000,000, with the contention that through a further readjustment to be disclosed later this figure might be somewhat reduced.

According to the testimony of the city, speaking through its rate experts, J. W. Carey and Kenneth Harlan, the rate-base valuation should be only $57,750,000. This discrepancy between the city's valuation and those of the com-

mission and the company comes about, Mr. Carey testified, through the alleged erroneous inclusion of certain items which the city will contend should not be allowed in the rate base.

The hearing was again adjourned for an indefinite period. It may be resumed later this month on one day's notice.

Governing Hydro Units

Good Discussions on This and Other Topics Characterized Meeting of Empire State Association's Electric Section Last Week

EARNEST discussion and considerable difference of opinion in regard to frequency control and the governing of hydro-electric units were features of the annual meeting of the Electric Section of the Empire State Gas and Electric Association, which was held at Briarcliff Manor, N. Y., on Thursday and Friday of last week. As parts of a general symposium on the subject, reports were made for the apparatus, operating and hydraulic power committees respectively by Raymond Henry, Niagara Falls Power Company; G. A. Powell, New York Power & Light Corporation, and E. D. Strowger, Niagara Falls Power Company.

This session, held on Friday, was presided over by Byron E. White, Utica Gas & Electric Company. A number of guests participated in the discussion. S. Toyan Kerr, research engineer, I. P. Morris & De La Vergne, Inc., spoke on the relation of frequency to load control and pointed to the recent successful attempts to obtain the most efficient operation of hydro plants automatically and to maintain frequency in a similar manner. Robert Brandt, assistant engineer New England Power Association, told of experiences and operation with automatic-control equipment. C. W. Mayott, manager Connecticut Valley Power Exchange, stressed the importance of accurate timing. John L. Harvey, superintendent power control, New York Power & Light Corporation, reviewed tie-line load influences. C. F. Merriam, Pennsylvania Water & Power Company, covered the desirable generator characteristics. George Keenan, Pennsylvania Power & Light Company, urged frequency regulation distributed at many points rather than having one unit regulate for the group. H. E. Warren, Warren Telechron Company, discussed some of the principles which time-frequency control involves.

On Thursday E. K. Karcher, distribution engineer, New York Power & Light Corporation, discussed the use of series capacitors for voltage regulation and their inherent ability to improve the performance of rural lines. The rural lines committee, of which G. H. Fiedler, Rochester Gas & Electric Company, is chairman, reported upon new types of highway lighting and improved service.

Results of a survey of equipment performance when subjected to lightning discharges, which constituted a comprehensive account of arrester operation, were reported by O. G. Whitecotton and J. F. Werner of the New York Power & Light Corporation and New York & Queens Electric Light & Power Company respectively. O. P. Anderson, Edison Lamp Works, urged that full normal voltage be maintained within the customer's premises.

Colonel J. P. Hogan, who has been analyzing factors influencing the electrification program of the New York Central Railroad, reviewed some of his findings at the banquet on Thursday.

S. H. Abbey, Northern New York Utilities, Inc., acting chairman, was elected chairman for the coming year, and T. R. Eilenberg, New York & Queens Electric Light & Power Company, was made vice-chairman.

Purchases and Mergers

Acquisition of the Natchez (Miss.) electric light and power plant, previously the property of the Southwestern Gas & Electric Company, by the Mississippi Power & Light Company is announced. This transfer groups the Natchez utility with the Couch interests and their extensively interconnected systems in Arkansas, Mississippi and Louisiana. The Natchez plant was the only one in Mississippi owned by the Southwestern Gas & Electric, which is an Insull property, with headquarters at Shreveport, La.

An Alliance (Ohio) correspondent of the ELECTRICAL WORLD reports that by an agreement recently consummated the Utilities Power & Light Corporation has assumed general operating management of the Suburban Light & Power and the Utilities Service Company, both of Alliance, for a three-year period. In the issue for November 23 these negotiations were incorrectly represented as a sale. Purchase of a 12,500-kw. turbine to be installed by March 1, 1930, is reported.

The New York Public Service Commission has approved the transfer of the franchises and system of the Wayland Electric Light & Power Company to the New York State Electric Corporation. The petition of the Lockport Light, Heat & Power Company for consent to transfer its electric franchises and property to the same corporation has also been granted.

The Alabama Public Service Commission has approved the petition of the General Water Works & Electric Company to absorb the River Falls Power Company, Pea River Power Company, Andalusia Light & Power Company, Opp Light & Power Company and Alabama Utilities Company, all in south Alabama.

The People's Gas & Electric Company, Mason City, Iowa, will purchase the plant and equipment of the Plymouth (Iowa) municipal electric plant for $12,000 under authority granted at a special election.

The Illinois Commerce Commission has authorized the Davis Junction Electric Company to sell to the Rockford Electric Company all its properties for $25,000.

City commissioners of Beatrice, Neb., have been advised by the city attorney that they may submit to the voters the question of accepting the bid of the Iowa-Nebraska Light & Power Company to pay $150,000 for the municipal lighting plant.

The dam, power plant and flowage rights of the Cornell Wood Products Company at Cornell, Wis., have been purchased by the Northern States Power Company.

Mooresboro, N. C., recently joined its neighbors, Ellenboro and Lattimore, in voting to sell its electric distribution system to the Southern Public Utilities Company.

Submarine-Cable Operation at 75,000 Volts

Line Under Delaware River from Deepwater Plant Will Form Link in Transmission System Linking New Jersey, Delaware and Eastern Pennsylvania

AN IMPORTANT link in the so-called Philadelphia super-power system was completed on December 6 when four cables of an eight-cable submarine transmission line were laid in a trench approximately 10 ft. under the bed of the Delaware River between Deepwater Point, N. J. and Pigeon Point, Del.

The submarine line ties the Deepwater power plant, on the east bank of the Delaware River 4 miles south of Pennsgrove, N. J., into the system of the Delaware Electric Power Company, Wilmington, and the Philadelphia Electric Company's hydro-electric system from Conowingo and its steam station system in Philadelphia and suburbs. The Deepwater power plant, jointly owned by the United Gas Improvement Company and the American Gas & Electric Company of New York, will be put into operation early in January and will be one of the important sources of power for the eastern Pennsylvania, New Jersey and Delaware region.

The cables are designed for operation at 75,000 volts, which is said to be the highest voltage ever used on a submarine line. Four similar cables were laid in this trench a week before. The completed line thus consists of two three-phase circuits with a spare cable for each circuit.

More than one hundred officials and engineers were guests last week of the United Engineers & Constructors, Inc., which designed and supervised the laying of the line. The party, aboard a chartered boat, witnessed the completion of the cable line. It had involved some difficult engineering and tedious construction problems.

The station, one of the most modern plants of its kind, was fully described in the ELECTRICAL WORLD for May 11 last (page 919). Its initial capacity will be 128,500 kw., with provision for an ultimate rating of 400,000 kw. The plant will be connected with the submarine cable on the Jersey side by two aërial lines running to the Christiana substation of the Delware Power & Light Company in Wilmington, which is connected with the Philadelphia Electric Company's system at the Pennsylvania-Delaware state line. It will be connected with the American Gas & Electric Company's Atlantic City property by high-voltage aërial lines through Woodstown, Paulsboro, Salem and Pleasantville.

Hearing in Wisconsin on New Merchandise Sales Law

The Wisconsin Railroad Commission held a public hearing on November 29 at Madison to obtain the views of public utility companies and general merchandisers of appliances with reference to an accounting law passed at the last session of the Legislature applying to merchandise sales by public utilities. The commission must issue an order to comply with the law, which requires that utilities shall keep separate accounts to show all profits or losses resulting from the sale of appliances or other merchandise accounting and that no such profit or loss shall be taken into consideration in establishing rates.

Utility spokesmen pointed out with definite examples that they could not draw an arbitrary accounting distinction for all companies between promotional activities and purely merchandising sales, because a specific accounting classification would do grave injustice to some companies owing to local conditions. Spokesmen for contractors, when asked by commissioners to suggest a definite method whereby the commission could determine what is promotional expense and what is purely merchandising expense, said they could not offer a specific plan. However, they criticised the utilities, asserting that losses through merchandising had been charged to general operating expense.

The commission had intended to issue an order before the first of the year, but because of the complexity of the situation it is likely that it will be postponed for several months.

A. B. Walton, manager of the Association of Certified Electricians, North Olmsted, Ohio, attended the public hearing. He did not testify, but after the hearing he gave an interview to the newspapers in which he said that action will be brought against the utilities before the Federal Trade Commission to compel them to keep separate accounts for the sale of merchandise.

Three Petitions Approved by Federal Power Commission

The preliminary permit of the Wisconsin Power & Light Company has been extended by the Federal Power Commission for one year so as to allow more time for negotiations between the power company and the Menominee Indian tribe in connection with the proposed 14,000-hp. project on Wolf River within the Menominee Indian reservation. The action was taken at the request of the tribe's water-power committee and was acquiesced in by the power company and the Office of Indian Affairs.

The commission has approved the amendment of the license of the Pacific Gas & Electric Company covering its project on the Mokelumne River in California. Under the amendment the company will increase the storage capacity of its Salt Springs reservoir. The height of the dam will be increased so that 70,000 acre-feet will be added to the storage. An additional power plant is to be installed at Salt Springs dam and the installation at Tiger Creek is to be increased to 70,000 hp.

The Yuba River Power Company was authorized to transfer its license covering a project on the North Fork of the Yuba River to the Pacific Gas & Electric Company.

The Waldo Lake Irrigation & Power Company of Spokane has applied to the commission for a preliminary permit covering a project on the north branch of the Middle Fork of the Willamette River and on Salmon Creek. It is planned to construct a power house near the mouth of the north branch. Water will be diverted through a canal 12½ miles long connecting the power house with Salmon Creek and through a canal 11 miles long connecting with the north branch. Two additional power houses are to be constructed on Salmon Creek above the point of diversion. Primary power to the extent of 25,000 hp. will be available at the first power house. The other two sites have not been surveyed.

George T. Cameron of San Francisco has applied for a preliminary permit covering a project at the outlet of Dorothy Lake in Alaska.

A.S.M.E. Hears Papers on Power

Factors of Availability and Cost as They Affect Boiler Installations—Hydro-Electricity Discussed in Several Aspects—Engineers in Wider Spheres

TWO topical groupings—central-station power and hydraulics—at the fiftieth annual meeting of the American Society of Mechanical Engineers, held in New York City last week, were in the sphere of the men whose interests lie with the light and power industry. At a session devoted to central-station power there were two papers in addition to the progress report of the Power Division. One of these papers, by C. F. Hirshfeld of the Detroit Edison Company and G. U. Moran, embraced a report of studies made to determine the factors affecting the availability of steam generating units. The other, by Frank S. Clark of the Stone & Webster Engineering Corporation, was a discussion of the economic factors involved in the use of larger boiler units.

The data collected by Messrs. Hirshfeld and Moran indicate that boiler outage is not proportional to severity of use, and, in fact, seem to show a slight increase in availability with increase in severity of use. The authors believed it reasonable to assume that this is the result of more careful design and operation in the case of equipment that is driven at the higher rates.

They estimated that part of the total crippled hours chargeable to the fuel-burning equipment and furnace. From these data and the total hours reported it was found that the highest availability was obtained for oil- and gas-fired units, slightly lower availability for pulverized-fuel-fired units, and lowest availability for stoker-fired units. Some fairly definite indications were obtained that air preheaters, on the average, decreased the availability factor by about five points. Plant operation pressures seemed to have little effect.

Boiler-plant investment costs, Mr. Clark found, are largely determined by the size of individual steam-generating units and the output obtainable from each unit. The size and number of boilers affect the cost, not only of these units themselves, but also of the equipment that goes with them and of the building. For a given output the percentage of building space devoted to aisles and firing floor decreases appreciably with the increase in the size of boilers. There is also a saving in building steel work, piping and equipment for fuel handling and burning. In the furnaces the setting walls have less area per unit of furnace volume as the combustion space increases. Boilers themselves are less expensive per unit of output in larger sizes. There is likewise a saving in auxiliary equipment.

Five papers and a progress report in the hydraulic sessions covered a wide range of subjects, including the economic relation between hydro- and steam-plant capacity, increased kilowatt-hour output possible with adjustable-blade propeller-type turbines, vibration in penstocks, changing conditions in waterwheel regulation, and the mechanics of speed regulation.

Prof. E. E. Free of New York University, discussing the problem of floating soot, said that most of it comes from office buildings, apartment houses and residences and not from the large power houses and other industrial plants.

Men of science are assuming a dominant position in American life, Lawrence W. Wallace of Washington, executive secretary of the American Engineering Council, said in an evening address. By supplementing with broad humanistic and scholarly interests the technical genius responsible for the "machine age" they are becoming a controlling force in culture and in politics no less than in commerce, industry, finance, education and national defense.

Other addresses at the evening meeting were by Edward Eyre Hunt, secretary of President Hoover's committee on recent economic changes, and Dr J. R. Angell, president of Yale University, who declared that the most able teachers are being tempted from the technical schools by the opportunities for research and advancement afforded by the great laboratories established by our industries.

Doubt Cast on Legality of Indiana Merger

Attorney-General of State Interprets the Law on Request of a Member of the Public Service Commission—Motion to Dismiss Petition

FOLLOWING four days of hearings in the proposed "seventy-million-dollar merger" of electric, gas, interurban and bus utilities controlled by Insull interests, the Indiana Public Service Commission adjourned on the evening of December 6 to consider procedure on a motion to dismiss the merger petition. The dismissal motion was filed by Harvey Harmon, former commissioner, and others representing the Utility Service Bureau, Inc., and the Indianapolis Federation of Community Civic Clubs. It alleges that the proposed merger violates the commission law because it is an attempt to unite in a single corporation dissimilar utilities serving widely separated municipalities and localities. The petitioning companies have finished their case and the opposition will take the stand when the case is resumed.

Determination of the powers of the Indiana commission in this case rests in the first instance with the commission itself, according to an opinion issued by James M. Ogden, Attorney-General of Indiana. The opinion, written at the individual request of Calvin McIntosh, a member of the commission, answered four questions relative to the legality of the merger and the commission's jurisdiction. In it Mr. Ogden said that, under provisions of the law, utilities must render similar services in the same localities in order to merge. The commission has no authority to authorize mergers between "a utility whose primary service to the public is the furnishing of transportation and a public utility whose primary service to the public is furnishing of heat, gas or other dissimilar service or commodity. Only utilities having a primary similarity of service may merge under the act."

The question, "Does the expression in the utility act 'doing business in the same municipality or locality within the state' permit the merging of property scattered throughout the state from Edwardsport to Gary and from Terre Haute to Richmond?" Mr. Ogden answered in the negative. He said further: "It seems quite clear that only utilities rendering a similar service or product could be so related to each other as to fall within the meaning of intersecting or parallel lines when applied to competitive services rendered, and [this] would require an actual intersecting or paralleling of its pipes, rails or wires, as might arise in different cases."

Soon after Mr. McIntosh requested the opinion, it was explained by other members of the commission that the opinion had not been asked by that body. At that time the Attorney-General said he would render an unofficial opinion, but he announced later that the opinion was "official" and would be incorporated with other published opinions of the office. "Members of the commission may determine for themselves whether they wish to accept it as official so far as they are concerned," he added.

Briefer News

DOUBLING THE CAPACITY OF MACON (GA.) SUBSTATION.—Work of construction on an addition to the South Macon substation of the Georgia Power Company, now nearing completion, includes the installation of a 25,000-kva. transformer bank which will double the present capacity of the station. A 15,000-kva. synchronous condenser is also being added.

SEEK GOVERNMENT APPROPRIATION TO ILLUMINATE OREGON CAVES.—Pending the action of Congress upon an application for an appropriation for the installation and operation of electric power in what are known as the Oregon Caves, Philip H. Dater, United States district engineer for the Forest Service, is making a survey of the water volume of the streams in and adjacent to the natural scenic attraction.

LOS ANGELES GAS & ELECTRIC HAS NEW RATES.—The Los Angeles Gas & Electric Corporation has obtained permission from the California State Railroad Commission to file electric rate schedules which will make its tariff the same as that which the Los Angeles Bureau of Power and Light is to put into effect on January 1. Under this new rate schedule the first block to the domestic consumer will be charged at 4.8 cents per kilowatt-hour for dwellings having five or fewer circuits.

NEW ORLEANS TO CELEBRATE NEW STREET-LIGHTING SYSTEM.—The new street-lighting system installed at the cost of a million dollars on Canal Street, the famous main thoroughfare of New Orleans, will be inaugurated about January 1 by a display of fireworks, with airplane stunts, a moment of complete darkness just before the new lights are turned on and other spectacular accompaniments. For eighteen blocks the stores will be brilliantly lighted up, according to the plans.

STILL ANOTHER 35,000-KW. UNIT FOR KANSAS CITY.—The Kansas City Power & Light Company, which, as recorded on December 7 (page 1145), has just put into commission a new 35,000-kw. turbo-generator at its Grand Avenue generating station, will add another one of the same rating to that station, which, it is reported, will be completed next fall. This will bring the total capacity of Grand Avenue, the old railway plant, within hailing distance of the 140,000-kw. rating of the company's Northeast station.

NEW SUBSTATION FOR SPRINGFIELD (ILL.) MUNICIPAL PLANT.—A substation to have an ultimate capacity of 6,000 kva. is under construction at First Street and Cornell Avenue for the municipal electric light and power plant at Springfield, Ill. The station, which it is expected will be in operation some time in January, will have an immediate installation of 2,400 kva. at a cost of $100,000, including the building.

COMPETITION AT HAMILTON, OHIO.—Following tests, city officials at Hamilton, Ohio, expressed satisfaction on December 5 with the new 7,500-kw. generator in the municipal electric plant. The plant will now have a potential output of 13,750 kw. and, according to officials, will put the city in better position to compete with the Hamilton Service Company for power and lighting business.

IMPROVING ELECTRIC SERVICE IN LINCOLN, NEB.—The Iowa-Nebraska Light & Power Company has contracted for a new steam plant at Lincoln, Neb., and the entire distributing system of the city will be rebuilt. The last of the duplicate lines of the Lincoln Traction Company, the lighting department of which was taken over under purchase, will be removed. More than $3,000,000 is to be spent in 1930 by the company.

ANTIOCH COLLEGE TO SUPPLY VILLAGE OF YELLOW SPRINGS, OHIO, WITH ENERGY.—The Yellow Springs (Ohio) Village Council has voted to accept the bid submitted by Antioch College in competition with a utility company to supply it with electrical energy for ten years beginning December 31. The new college power plant, noted in the November 30 issue of the ELECTRICAL WORLD (page 1097), will be completed by that time.

ST. LOUIS COMPANY PLANS FOR FUTURE.—Louis H. Egan, president of the Union Electric Light & Power Company, St. Louis, has announced that his company contemplates addition, probably in 1931, to its Cahokia power plant of a unit which will add 75,000 kw. to the plant's rating and cost about $2,000,000. The Union Electric company has now 1,800 men at work on its hydro-electric plant on the Osage River at Bagnell, Mo. This project is scheduled for completion in 1931.

ELIZABETH, N. J., HAS CHANCE TO GET MODERN STREET LIGHTING AT ACTUAL SAVING AS COMPARED WITH GAS.—Elizabeth, N. J., is considering a proposal by the Public Service Electric & Gas Company to substitute electric illumination for gas, with almost twice as much candlepower, at an estimated saving of $2,000 a year. A five-year contract for 1,693 gas lamps at $49,000 a year, held by the Elizabethtown Consolidated Gas Company, will

expire next June. The Public Service company offers to supply electric lighting at approximately $47,000 each year and furnish all equipment.

RIVERBEND PLANT OF DUKE POWER COMPANY INSPECTED. — Approximately 175 engineers from the Piedmont Carolinas were the guests of the Duke Power Company on Monday, December 9, at a luncheon and inspection tour of the Riverbend steam-electric plant, one of the largest in the entire South, which was recently completed on the Catawba River near Mount Holly, N. C., with 112,000 kw. of its ultimate 450,000 kw. installed. W. S. Lee, vice-president and chief consulting engineer of the Duke Power Company, acted as host, and E. E. Williams briefly described the plant, which was placed on the line October 23.

NEW-KANAWHA DAM CONSTRUCTION WILL WAIT FOR SPRING.—Because of the better working conditions which prevail during the summer the Public Service Commission of West Virginia has authorized the New-Kanawha Power Company to postpone starting the construction of its proposed dam at Hawk's Nest and hydro-electric power plant in Mountain Cove district, Fayette County, until May 1, 1930.

PLANS READY FOR 110-KV. LINE FROM MONTOUR FALLS TO HORNELL, N. Y.—Plans for a new substation at Bath, N. Y., to regulate service voltage in the Cohocton Valley and for a new 110-kv. power line from Montour Falls to Bath and Hornell were announced recently as part of the Associated Gas & Electric Corporation's development program. The new power line will connect with another 110-kv. line linking Geneva and Elmira. Hornell and Southern Tier territory will thus be assured of an extra source of supply in addition to the present 33,000-volt line between Perry and Elmira.

SPIER FALLS TO HAVE WATERWHEEL OF UNUSUAL SIZE. — The waterwheel which is to drive the General Electric generator to be installed by the New York Power & Light Corporation at its Spier Falls hydro plant on the upper Hudson is being built by the Norfolk News Shipbuilding Company and will be one of the largest ever built. It will weigh 150 tons and its diameter of 20 ft. is five times as great as that of the waterwheels originally installed at this plant. It will require 6,200 sec.-ft. to operate it at full load, or the entire flow of the Hudson River during low-water period.

DOLLAR TO BUILD ELECTRIC SHIPS FOR TRANSOCEANIC SERVICE.—The first electric passenger vessels for transoceanic service are to be built by the Newport News Shipbuilding & Dry Dock Company for the Dollar Steamship Line. Two sister vessels over 600 ft. long, with turbine-electric propulsion and complete electrical equipment, are to be constructed. They will be of twin-screw design and built for a speed of 20 knots. The first one will be completely electrified by the General Electric Company and will have accommodations for 450 passengers and a crew of more than 300. The power plant will consist of two turbines running at 2,500 r.p.m. and driving two alternating-current generators each having a continuous rating of 10,100 kw., three-phase, 4,800 volts. These generators will drive two 13,250-hp. synchronous-induction motors, each connected to one of the two propeller shafts which will turn at the rate of 133 r.p.m.

COMING GREAT LAKES MERCHANDISE CONFERENCE.—The annual merchandise conference of the Commercial Section of the Great Lakes Division of the N.E.L.A. will be held at the Edgewater Beach Hotel, Chicago, on January 21-22. Stanley Jenks, conference chairman, announces. The merchandise conference will be included with the commercial conference, the latter beginning on January 20 and being devoted to power sales and electrical advertising. The merchandise conference covers all major phases of merchandising by central-station companies and is particularly designed to interest all who are engaged in central-station sales work in a supervisory capacity.

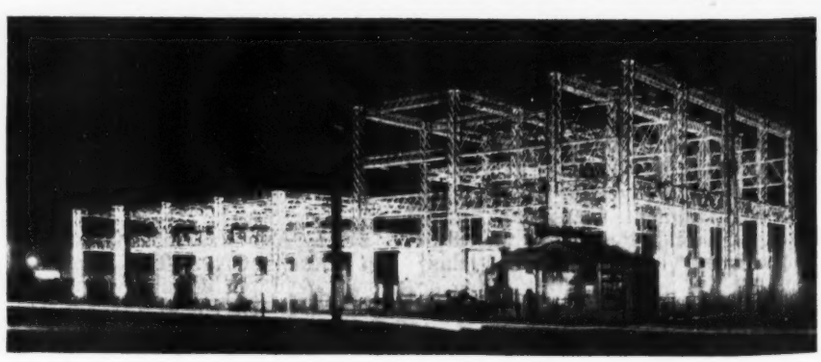
SEATTLE AND EVERETT (WASH.) APPLICATIONS FOR STREAM FLOW CONFLICT.—Application made by the city of Seattle, Wash., to the state hydraulics office for the appropriation of 600 sec.-ft. of water from the Sultan River, a tributary of the Skykomish, for municipal water and power purposes, draws attention to the fact that prior appropriations have already been granted the city of Everett, which obtains its supply, totaling 180 sec.-ft., from the Sultan River, while another application, made November 12, asks an additional 200 sec.-ft. The total stream flow is not sufficient for both applications.

BEAUHARNOIS POWER CORPORATION WILL SELL 150,000 HP. TO MONTREAL UTILITY. — The Beauharnois Power Corporation, whose contract to sell 250,000 hp. of energy from its coming hydro plant on the St. Lawrence River to the Ontario Hydro-Electric Power Commission was noted last week (page 1144), has announced that it has also made a contract by which the Montreal Light, Heat & Power Consolidated will take 150,000 hp. of the 500,000 hp. to be developed. It is expected that before the completion of the plant the corporation will have disposed of the remaining 100,000 hp.

VANCOUVER, B. C., FAILS TO GET RESERVATION ON POWER SITE. — The provincial government of British Columbia has given notice to the Vancouver City Council that it cannot definitely reserve the Cheakamus River powers for that city, but that the Council, which had applied for the reservation in view of the possibility of the city's entering the light and power field against the British Columbia Electric Railway Company, will have an opportunity to file objections or to enter alternate plans for development before any other disposition is made of the Cheakamus power rights.

ARTISTIC LIGHTING EQUIPMENT ASSOCIATION WILL CONVENE IN WASHINGTON.—The 1930 convention and fixture market of the Artistic Lighting Equipment Association, the national association of lighting fixture manufacturers and dealers, will be held in Washington, D. C., February 9 to 15. Washington has been selected, Managing Director Charles L. Benjamin says, because all previous conventions have been held in Great Lake cities—Detroit, Milwaukee, Chicago, Cleveland and Buffalo—and it has been thought desirable to select a city midway between North and South in the hope that Southern dealers will attend in greater numbers.

Tulsa Substation of Public Service Company



THIS substation, erected in the northeast part of Tulsa, serves as a sectionalizing point on the Public Service Company of Oklahoma's 66,000-volt system to northeast Oklahoma. It is equipped to convert 66,000-volt energy to 33,000, 13,200 and 4,400 volts. It has a present capacity of 15,000 kw. The lighting is accomplished by floodlamps installed in the base of the columns of the structure. The projectors create a shaft of light up the substation columns. All equipment is thus as easily seen at night as at day.

CONNECTICUT'S PUBLIC UTILITIES COMMISSIONERS SECURE. — The Attorney-General of Connecticut has declined to act on the petition to bring proceedings to remove all the members of the Public Utilities Commission of the state on the ground of alleged failure to enforce a law for the elimination of grade crossings. The refusal to act says that the petitioners do not set forth material facts on which proceedings must be based.

MODEL OF MOUNT MORRIS DAM USED FOR ENGINEERING DEMONSTRATION.—The effects of thousands of tons of water tumbling nearly 200 ft. into the Genesee River from the top of the spillway of the coming dam of the Rochester Gas & Electric Corporation at Mount Morris, N. Y., were demonstrated satisfactorily on December 7 by means of a working model of a portion of the dam. The demonstration took place in the utility corporation's hydraulic laboratory, on the river bank, before members of the American Institute of Electrical Engineers, the American Society of Civil Engineers and the Rochester Engineering Society. Carl C. Cooman, a member of the Rochester Engineering Society and civil engineer for the utility corporation, directed the demonstration. The model is a one-sixteenth-scale reproduction of one-fourth the total spillway width of the proposed dam. The sides are plate glass. Different sizes of screened gravel simulate riverbed conditions at Mount Morris. When the Mount Morris dam is completed it will form a lake 15 miles long. The dam itself will be 1,100 ft. long on top, 700 ft. long at the base and will have a maximum height of 230 ft. above the foundation.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue of July 6, page 46.]

American Engineering Council—Washington, Jan. 9-11. L. W. Wallace, 26 Jackson Place, Washington, D. C.

Conference of Electrical Leagues—Westinghouse Lighting Institute, New York, Jan. 13-16. Society for Electrical Development, 420 Lexington Ave., New York.

Empire State Gas and Electric Association—Women's Section, Hotel Seneca, Rochester, Jan. 16-17. C. H. B. Chapin, Grand Central Terminal, New York.

North Central Division, N.E.L.A.—Commercial Section, St. Paul Hotel, St. Paul, Jan. 20-21; Engineering Section, Nicollet Hotel, Minneapolis, Feb. 24-25. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

National Electrical Credit Association—New England Division, University Club, Boston, Jan. 21. F. P. Vose, 1008 Marquette Bldg., Chicago.

American Institute of Electrical Engineers—Winter meeting, New York, Jan. 27-31. F. L. Hutchinson, 33 West 39th St., New York.

National Electrical Wholesalers' Association—Pacific Division, Del Monte, Calif., Jan. 31-Feb. 1.

Artistic Lighting Equipment Association—Washington, Feb. 9-15. C. L. Benjamin, 420 Lexington Avenue, New York.

Recent Court Decisions

DAMAGES FOR DISCONTINUANCE OF SERVICE FOLLOWING DISPUTE OVER METERS.—A verdict of $500 awarded the Warren Ellison Café of Hickman, Ky., as damages because the Kentucky Utilities Company discontinued its power and light service has been upheld by the Kentucky Court of Appeals. The plaintiff alleged that the meters were faulty and that an agreement had been reached relative to reducing the amount assessed on the basis of the meter readings, but that the utilities company refused to accept payment on the reduced amounts and discontinued light and power service.

RIGHT OF EMINENT DOMAIN CANNOT BE REFUSED BECAUSE IT WILL BENEFIT PEOPLE OUTSIDE THE STATE.—In Shedd vs. State Line Generating Company the plaintiff, a property owner in Indiana, objected to the taking of his land in eminent-domain proceedings by the defendant on the ground that if this were done his property would be seized to benefit the people of another state—Illinois—as well as those of Indiana. The United States District Court overruled this contention, saying: "While it undoubtedly is the law that the power of eminent domain will not be exercised merely to benefit the public of a foreign state, but is limited in its operation to be used only for the benefit of its own citizens and communities, it should also be kept in mind that this right to condemn will not be refused merely because the peoples and communities of another state will be likewise benefited. To hold otherwise would be to take a too narrow and circumscribed attitude and in many instances would result in effectually blocking large enterprises by limiting the benefits to be derived from their operations to an area entirely too small for efficient and profitable operation and thus deprive the people of the state in which the power is to be exercised of the benefit of progress and industry. Electric power is as necessary to the life of a community as transportation or communication facilities. As well limit railroads, interurbans, bus lines, telephone or telegraph lines as to limit the production, transmission and distribution of electricity. Defendant must have an outlet for its energy or limit its capacity. The time may come when the people of northern Indiana will require all the energy defendant is able to produce and market. Against that time defendant should be permitted to produce and sell its entire capacity, even if a large amount goes into Illinois. When the time comes that the people of Indiana need all the energy defendant can supply, no doubt defendant will be glad of the opportunity to dispose of its product at home, but, if it should not, the courts and officers of the state will undoubtedly find a way to prevent discrimination against their own citizens and communities." (34 Fed. [2d] 287.)*

PUBLIC UTILITY NEED NOT SELL ENERGY AT WHOLESALE RATES TO RETAILER NOT RANKING AS A DISTRIBUTOR.—A company which owns and maintains electric lines over which energy is delivered, charging tap fees for the use of the lines, but which is not now and never has been a distributor of electrical energy, cannot force a public utility which has not entered the field of delivering energy for redistribution at retail to furnish it for such purpose, according to a decision of the Supreme Court of North Carolina. The Holmes Electric Company, alleging that it was a public service corporation, made application to the Carolina Power & Light Company for the delivery of electrical energy at a substation for resale or redistribution. The power company refused the application on the ground that such resale would make the Holmes company a competitor with the power company or the city of Fayetteville, with which the power company had a contract for similar service. This contention was sustained by the North Carolina Supreme Court (Holmes vs. City of Fayetteville), which differentiated the case from others in which the defendant had entered the wholesaling field and, having done so, was forbidden to make arbitrary discriminations. The court declared that a legislative act authorizing a municipality to render a public utility service within a zone extending 3 miles beyond the city limits, when such service is maintained from profits arising from the business in the territory beyond the corporate limits, does not infringe the federal Constitution.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

KENTUCKY COMMISSION CANNOT REGULATE UTILITIES OPERATING UNDER CITY FRANCHISES.—The Court of Appeals of Kentucky has just handed down a decision that the State Railroad Commission is without authority to regulate public utilities in municipalities, because that power is vested in the cities by the constitution and the General Assembly could not amend that part of the constitution. The commission, the opinion held, has power only when a public utility company continues to operate after expiration of the franchise. The opinion was given in a ruling holding that the Union Light, Heat & Power Company has the right to withdraw its service from the city of Ludlow.

COMMISSION REFUSES TO SADDLE CITY CUSTOMERS WITH LOSSES FROM RURAL SERVICE.—One of the reasons why Governor Roosevelt's proposal to equalize electric rates in rural sections of New York State would not work was made clear the other day when complaints by customers in Volney, Oswego County, and the Town Board in Granby, Oswego County, against the minimum charge of $2.50 a month imposed by the Fulton Light, Heat & Power Company for electricity on rural lines were dismissed by the Public Service Commission. Evidence submitted at the hearing showed that the company has 29 miles of rural lines, serving 249 customers, an average of eight and one-half customers on every mile of rural line. During 1927 the company sold 89,066 kw.-hr. for $7,851, an average yearly charge per customer of $31.53. According to the evidence by the company showing the result of actual operation, it appeared that this class of electric business lost in 1927 $2,074 before any allowance was made for return on the value of the property used in giving service or for payment of fixed charges, and if the former minimum charge of $1 was continued, the annual loss due to the rural service must be borne by the users of electricity in Fulton.

News About Men of the Industry

Herman Russell Heads Rochester Utility

Directors of the Rochester Gas & Electric Corporation, meeting on December 6 in New York City, elected Herman Russell president of the company to succeed the late Robert M. Searle. Mr. Russell was made a vice-president of the company in 1922 after some twenty years' experience in the operation of public utilities. His first connection was in the gas branch of the industry, as an employee of the Detroit Gas Company. Within a short time he was occupying the position of assistant superintendent of that company, relinquishing the duties of this office to become superintendent of the gas-manufacturing department of the San Francisco Gas & Electric Company, a position he occupied for a year. Subsequently he removed to Cincinnati as superintendent of the gas and electric company, and it was after this connection that he transferred his interests to the East in 1904 when he became assistant superintendent of the gas works of the Rochester utility. He then occupied successively the positions of superintendent of gas manufacture, assistant general manager, general manager and finally, in 1922, he became vice-president of the Rochester Gas & Electric Corporation, which prior to this time had been known as the Rochester Railway & Light Company. Later in the same year he was named a director of the company.

L. M. Grow of Toledo has been appointed engineer for the Wooster Electric Company, Wooster, Ohio. Mr. Grow succeeds F. H. Bussler, who recently resigned. Robert Landau, who has been with the Wooster organization for many years, has been made superintendent of all construction and maintenance work.

Don M. Julien, formerly assistant advertising manager of the Graybar Electric Company, has been appointed advertising manager. Mr. Julien joined the parent organization, the Western Electric Company, in 1916 at Chicago. After serving in various capacities in the sales and service departments, in 1924, he was made assistant service manager of the Chicago office. In 1927, one year after the Graybar organization was formed, Mr. Julien was transferred to the New York executive headquarters of the company and appointed assistant advertising manager. His latest promotion comes after two years of service in the New York office. Mr. Julien is a graduate of DePauw University.

Thomas W. Drought, who has been connected for twenty years with the New York Power & Light Corporation and predecessor companies, has been given an assignment in the rate department at the company's headquarters in Albany. He was transferred from the position of commercial manager in the Gloversville district.

M. S. Bandoli, for nine years connected with the Northern States Power Company at Eau Claire, Wis., has been appointed sales manager with the Illinois Power & Light Corporation, with headquarters at Decatur. Mr. Bandoli entered upon his career with the Wisconsin-Minnesota Light & Power Company. When the Northern States Power Company took over the company in 1923, Mr. Bandoli continued his merchandising work, and later was given sales supervision of the company's Wisconsin stores.

Roy F. Burkhart, for the past two years electrical engineer in the operation and maintenance department of the United Gas Improvement Company, Philadelphia, Pa., has been appointed engineer in the electrical division of the Stone & Webster Engineering Corporation, Boston. Mr. Burkhart has had broad experience in electrical engineering and construction work, having held responsible positions with the American Gas Company, Philadelphia, Pa.; Luzerne County Gas & Electric Corporation, Kingston, Pa.; Cedar Valley Electric Company, Charles City, Iowa, and Western Electric Company, Chicago.

C. B. Hayes, formerly division superintendent at Lake Wales for the Florida Public Service Company, has been transferred to Orlando as division superintendent, and W. W. Wolff, for several years division superintendent at DeLand, has removed to Lake Wales to succeed Mr. Hayes. The Florida Public Service is part of the Associated Gas & Electric System. Mr. Hayes has been connected with the Florida Public Service Company since its entrance into central Florida in 1924. A native of Georgia, he has been in Florida since 1905, having formerly been connected with the Florida Ice & Power Company. He moved to Lake Wales in 1915 and has been connected with the power, light and ice properties there ever since. Mr. Wolff was also formerly with the Florida Ice & Power Company, being in its employ from November, 1919, until February, 1924, when the Florida Public Service Company bought out that property. He was district superintendent at Avon Park until 1927 and was then promoted to division superintendent of the DeLand division.

D. W. Jardine General Manager of Erie County Utility

David W. Jardine has been elected vice-president and general manager of the Erie County Electric Company to succeed Walter W. Gingrich, resigned. Mr. Jardine, who was born in Newington, Ontario, in 1885, began his business career in 1907 with the American Gas Company following his graduation from the mechanical engineering department of Lehigh University. He has resigned as vice-president of the Philadelphia Suburban-Counties Gas & Electric Company to remove to Erie. While with the American Gas Company, which controlled gas and electric properties in various parts of the country, Mr. Jardine was in charge of the construction of the electric plant at Waukesha, Wis., and the gas plant at East St. Louis, Ill., and in charge of electric and gas operations at Waterloo, Iowa, and Burlington, Vt. In July, 1928, he resigned as manager of the Burlington Light & Power Company to become a vice-president of the Philadelphia Suburban-Counties Gas and Electric Company.

Mr. Gingrich, who is a life-long resident of Erie, became associated with the Erie County Electric Company as assistant to the president, and shortly thereafter was elected vice-president in charge of finance. Previously he had served two terms as city comptroller. Mr. Gingrich decided some time ago to retire from active operation of the property, and it was with great regret that the board accepted his resignation, effective January 1. The company will, however, continue to benefit from his long experience and sound judgment, as he will remain on the board of directors.

E. P. Harrison, formerly of Watertown, S. D., has been appointed manager of the Northwestern Public Service Company at Mobridge, S. D.

S. F. Allen, formerly resident manager of the New York Power & Light Corporation at Cohoes, has been appointed electrical superintendent of the new operating district comprising Troy, Cohoes, Waterford and Watervliet, with offices in Troy. Mr. Allen first became associated with the company in 1916, when he became electrical superintendent at Cohoes. In 1918 he became general superintendent of the Cohoes Power & Light Corporation, becoming resident manager under the New York Power & Light Corporation in 1927.

R. J. Throckmorton New Vice-President in Norfolk

R. J. Throckmorton, general manager of the electric department of the Richmond division of the Virginia Electric & Power Company, has been elected vice-president of that company with headquarters at Norfolk. Mr. Throckmorton is a graduate of Virginia Military Institute at Lexington, holding B.S. and E.E. degrees from that institute. Immediately upon graduation he entered the service of the Virginia Electric & Power Company at Richmond, then the Virginia Railway & Power Company, as distribution engineer, and served as such until 1917, when he entered the World War.

After being relieved from active service he returned to the Virginia Electric & Power Company as distribution engineer at Norfolk, remaining until 1923, when he was promoted to be superintendent of light and power of the Norfolk division, which position he held until the spring of 1926, when he was promoted to be general superintendent of light and power with offices in Richmond.

E. L. West, vice-president of the Niagara Hudson Power Corporation, has resigned.

L. J. Callahan, who has been connected with the Northern States Power Company for the past five years, has been named manager of the Dakota Public Service Company, Jamestown, N. D., to succeed F. C. Wilson, who has assumed new duties in Nebraska.

Joseph Gibbons, formerly a member of the Board of Control and a member of the City Council of Toronto for the past ten years, has been appointed a member of the Toronto Hydro-Electric Power Commission, to succeed the late P. W. Ellis.

W. R. Wood, formerly senior vice-president of the International Combustion Engineering Corporation, was elected president at a directors' meeting held December 6 to succeed George E. Learned, resigned. George L. Bourne was elected chairman of the executive committee.

William F. Ryan has joined the Stone & Webster Engineering Corporation at the Boston office as engineer in the mechanical division, coming from the engineering departments of the Solvay Process Company and Atmospheric Nitrogen Corporation, with which companies he had been connected since 1924. Previous to that time he had spent several years with the Harry M. Hope Engineering Company as steam engineer, with the Wright-Martin Aircraft Corporation as plant engineer, and with the Interborough Rapid Transit Company on power plant operation and construction.

Dr. Irving Langmuir, president of the American Chemical Society and associate director of the research laboratory of the General Electric Company, was awarded the Chandler medal for achievement in science for 1929 by Columbia University. The medal was established in 1910 by friends of the late Prof. Charles Frederick Chandler, pioneer in industrial chemistry and a founder of the American Chemical Society, with a gift which constitutes the Chandler Foundation. This is the second medal to be bestowed upon Dr. Langmuir during the present year by Columbia, from which institution he was graduated in 1903 with the degree of metallurgical engineer. At the last commencement Dr. Langmuir received the class of 1889 medal, awarded every three years to a graduate of the School of Engineering or of the School of Architecture who shall have distinguished himself in any sphere of human effort. Dr. Langmuir's researches in the constitution of the universe have produced many notable discoveries.

M. Montgomery, city electrical engineer at Nelson, B. C., has tendered his resignation to the City Council, the resignation becoming effective at the end of this year. Mr. Montgomery plans to enter business at Vancouver, B. C.

Obituary

Wallace W. Briggs

Wallace W. Briggs, since 1925 vice-president and general manager of the Grays Harbor Railway & Light Company, Aberdeen, Wash., died in that city December 9. Mr. Briggs was well known in public utility circles in the West. For a number of years he was San Francisco district manager for the Westinghouse Electric & Manufacturing Company and later general manager of the Great Western Power Company of California. In 1918 he removed to the East to join the Westinghouse New York organization and subsequently became affiliated with the Federal Light & Traction Company, which controls the Grays Harbor company. Mr. Briggs was sent from New York to assume the executive duties of vice-president and general manager in Aberdeen. At the time of his death he was a member of the executive committee of the Northwest Electric Light and Power Association.

Samuel L. Powers, for many years a noted public utility lawyer of Boston, Mass., died at his home in Newton, Mass., November 30, at the age of 83. He was a former Congressman, was at one time chairman of the trustees of the Boston Elevated Railway and long practiced law in the telephone industry.

Edward D. Trowbridge, some few years ago active in public utility circles in this country and abroad, died suddenly, November 24, at his home in Detroit in his fifty-ninth year. After a successful career in the field of journalism Mr. Trowbridge entered the public utility field in 1893. He aided in the development of telephone and power and light companies in Brazil, Mexico and Spain and for a number of years was consultant for various American enterprises in Mexico.

James Gordon Baldwin, formerly secretary and treasurer of the Middletown Gas Light Company, Middletown, Conn., and since the merger of the gas company with the Connecticut Light & Power Company office manager of the Middletown division, died November 28 at his home in that city. Mr. Baldwin was born in Middletown in 1871.

Maurice A. Oudin, 63, vice-president of the International General Electric Company, died, of pneumonia, at his home in Schenectady, N. Y., December 4. A graduate of the College of the City of New York and of Princeton University, Mr. Oudin joined the Thomson-Houston Electric Company, Lynn, Mass., and continued in various capacities with its successor, the General Electric Company, at Schenectady. He was active in the power and mining interests and served for a time as acting district manager of the Denver territory. On his return to Schenectady he was chosen to consolidate and extend the engineering work of what was then the foreign department of the General Electric Company. With this accomplished, he was put in general charge of the company's export interests and relations, being made manager of the foreign department in 1904. In this capacity he traveled extensively in Russia, China and Japan, establishing new connections. In 1919 the International General Electric Company was formed to take over all the activities of the parent company with relation to foreign business and Mr. Oudin was appointed its first vice-president. With a background of long experience in foreign business Mr. Oudin was a recognized authority on the subject of international trade and economics.

Financial and Statistical News

POWER AND LIGHT companies are again in the market for new capital. Not since the October market break had any public issues been announced till this week, with a minor exception. The new issues, which will total around $20,000,000, are all bonds. Bond financing will lead for some time, according to indications.

——NEXT YEAR'S CONSTRUCTION PROGRAMS continue to be announced. They indicate a larger gain over 1928 than was anticipated.

——THE STOCK MARKETS SEEM TO HAVE ENTERED a trading phase, with the utilities among the most buoyant. The bond market made only a slight gain during the week.

Beauharnois Power Makes Substantial Offering

Beauharnois Power Corporation, Ltd., has just issued 30-year 6 per cent collateral trust sinking fund bonds totaling $30,000,000 at 100 and accrued interest with stock bonus delivery warrants and stock purchase warrants attached. These securities, dated October 1, 1929, will mature October 1, 1959. Beauharnois Power Corporation has been incorporated under the laws of the Dominion of Canada and is to own or control all the outstanding shares of Beauharnois Light, Heat & Power Company (which is carrying on the Beauharnois hydro-electric development) and of its associated companies, Beauharnois Land Company, Beauharnois Transmission Company and Beauharnois Construction Company. The entire proceeds of the issue will be used for the acquisition of the undertaking and assets of the Beauharnois Power Syndicate (including the whole of the issued stock of Beauharnois Light, Heat & Power Company), for proceeding directly or through subsidiaries with the construction of the Beauharnois power development, with the acquisition of rights and other property in connection with the project and for other corporate purposes.

New Capital Issues

Three-year convertible 6 per cent gold notes of the Federal Public Service Corporation to the amount of $1,500,000 have been offered the investing public at 97¾ and interest, to yield about 6.98 per cent. These notes will be used in part to provide funds for additions and extensions to be made to the properties of subsidiaries, to reimburse the company in part for such expenditures already made and also for other corporate purposes.

Detroit Edison Company issued general and refunding mortgage gold bonds, series A, at 100 and interest, yielding 5 per cent, a piece of financing involving a total of $13,516,000. These securities, dated October 1, 1924, and maturing October 1, 1949, are secured by a direct mortgage on the entire fixed property and franchises of the company and by the deposit of $12,500,000 first and refunding mortgage bonds. Upon completion of this financing, they will be further secured by the deposit of $13,516,000 additional first and refunding mortgage bonds. Application will be made to list these bonds on the New York Stock Exchange.

First and general mortgage gold bonds, series D, of the Central Maine Power Company have been offered to the amount of $3,000,000 at 98½ and interest, yielding 5.10 per cent. The securities of this additional issue were dated July 1, 1925, and mature July 1, 1955.

The proceeds will be used principally to reimburse the company for expenditures made in connection with the construction of the Wyman Dam on the Kennebec River, which it is expected will be in operation in the fall of 1930. These bonds are secured, in the opinion of counsel, by a first mortgage upon a substantial part of the Bingham development, including the power house and the principal part of the new dam referred to above, and upon the electric, gas and railway properties in Rockland, Thomaston and Camden, together with certain local distributing systems in

Current Earnings Reports of Electric Light and Power Companies

	1929	1928	Per Cent Increase	Operating Ratio 1929	Operating Ratio 1928
American Water Works & Electric & subs. (Year ended October 31)					
Gross earnings	$53,645,659	$50,536,509	6.1	50	52
Net earnings	26,613,511	24,483,840	8.7	..	..
Associated Gas & Electric System (Year ended October 31)					
Gross earnings	80,606,472	41,894,430	92.0	52	56
Net earnings	38,822,196	18,429,448	111.0	..	..
Bangor Hydro-Electric (Year ended October 31)					
Gross earnings	2,055,538	1,961,939	4.8	45	45
Net earnings	1,125,133	1,065,207	5.6	..	..
Eastern Texas Electric & subs. (Year ended October 31)					
Gross earnings	9,602,416	7,780,125	23.4	..	..
Net earnings	4,016,008	3,082,100	30.3	..	..
Eastern Utilities Associates (Year ended October 31)					
Gross earnings	9,269,102	8,470,453	9.4	..	..
Net earnings	3,685,462	3,088,015	19.4	..	..
El Paso Electric & subs. (Year ended October 31)					
Gross earnings	3,484,367	3,154,070	10.4	..	..
Net earnings	1,472,746	1,257,572	17.1	..	..
Electric Power & Light subs. (Year ended September 30)					
Gross earnings	58,102,713	54,079,593	7.5	51	54
Net earnings	28,256,641	24,788,723	14.0	..	..
Engineers Public Service (Year ended October 31)					
Gross earnings	48,854,103	30,933,612	58.0	58	59
Net earnings	20,524,070	12,653,172	62.0	..	..

	1929	1928	Per Cent Increase	Operating Ratio 1929	Operating Ratio 1928
Forth Worth Power & Light (Year ended October 31)					
Gross earnings	3,499,831	3,153,013	11.0	52	52
Net earnings	1,670,411	1,499,862	11.0	..	..
Galveston-Houston Electric & subs. (Year ended October 31)					
Gross earnings	5,262,425	5,232,683	0.5	..	..
Net earnings	1,697,676	1,702,420	—0.2	..	..
Idaho Power (Year ended October 31)					
Gross earnings	3,778,039	3,485,413	8.0	48	48
Net earnings	1,964,367	1,827,586	7.0	..	..
Nebraska Power (Year ended October 31)					
Gross earnings	5,902,166	5,234,683	13.0	51	53
Net earnings	2,903,912	2,474,929	17.0	..	..
Pacific Power & Light (Year ended October 31)					
Gross earnings	4,747,402	4,440,085	7.0	52	54
Net earnings	2,290,319	2,019,550	13.0	..	..
Portland Electric Power (Year ended October 31)					
Gross earnings	12,732,732	12,476,785	2.1	59	60
Net earnings	5,161,741	5,027,274	2.7	..	..
Puget Sound Power & Light & subs. (Year ended October 31)					
Gross earnings	16,123,553	15,126,118	6.6	..	..
Net earnings	6,757,494	6,513,966	3.7	..	..
Virginia Electric & Power & subs. (Year ended October 31)					
Gross earnings	16,961,697	16,072,270	5.5	..	..
Net earnings	7,555,136	6,852,375	10.2	..	..

other communities, which mortgage is also a lien upon the entire remaining physical property of the company.

Offering of a new issue of People's Light & Power Corporation one-year 5½ per cent notes, totaling $3,000,000, has been made during the past week. Proceeds will be used to retire unfunded debt, to reimburse the treasury for payments for additions and betterments, and for other corporate purposes.

Recent Listings

The New York Stock Exchange has authorized the listing on or after December 2 of 384,620.22½ additional shares of common stock of the Commonwealth & Southern Corporation (no par) on official notice of issuance as a stock dividend, making a total of 48,747,508.48¾ shares applied for to date. The big board has also authorized the listing of 271,200 additional shares of common stock (no par value) of the American Power & Light Company on official notice of issuance and distribution in payment of a stock dividend, making the total amount applied for 2,639,498 shares. Another stock authorized for listing on the New York Stock Exchange is the common stock of the United Gas Improvement Company numbering 2,299,668 shares, making the total amount applied for 22,624,503 shares. The New York Stock Exchange has authorized the listing of voting trust certificates representing 142,000 additional shares of common stock (no par value) of Servel, Inc., on official notice of issuance and payment in full, and 15,000 shares of common stock on official notice of issuance and payment in full, making the total amount applied for, voting trust certificates representing 1,756,561 shares of common stock.

Further Construction Programs for 1930 Announced

FOLLOWING the announcement last week of enlarged construction in the utility field on the part of several large power and light systems, others have followed with announcement of similarly enlarged programs.

In line with assurances given President Hoover by great utility concerns of the country in recent conferences on the industrial situation resulting from the stock market crash, the Duke Power Company is ready to spend approximately $15,000,000 in the Piedmont section of the two Carolinas as soon as authority is received for construction of links of the Piedmont & Northern Railway from Charlotte to Winston-Salem and from Spartanburg, S. C., to Gastonia, according to information received recently from Duke Power company officials.

The Georgia Power Company is also planning an active program, according to P. S. Arkwright, president. Referring to the scope of the program, Mr. Arkwright said:

"The expenditure of $16,000,000 for new construction and for improvements and enlargements of existing facilities is exclusive of the amount to be spent during 1930 in maintenance and operation of the company's electric, street railway and other services and for taxes, salaries, wages and other expenses. A total of $12,000,000 additional is provided for these expenditures, bringing the sum to be spent by the power company in Georgia during 1930 for materials and labor to a total of $28,000,000.

"We are not only going ahead full speed but on a larger scale than ever before in the company's history. We have full confidence in the future of the Southeast and particularly of Georgia. Electric power facilities must be built ahead of the demand for them, and we are bringing $16,000,000 of new capital into Georgia for investment in new generating stations, lines, substations and other facilities, not so much on account of the new industries which have come to Georgia in recent years, but as preparation for the additional new industrial growth which we feel confident the future will bring.

"The new construction work planned for 1930, however, is not entirely for the purpose of providing additional industrial power. It includes large sums for the purpose of extending electric service to Georgia communities which are now without electric service and for improvements of the service to present residential and commercial customers."

Heavy Program for Alabama

From Alabama also comes word of expansion programs. The Alabama Power Company announces that it will spend $14,000,000 during 1930 for maintenance, construction and operations. While no major developments of a new character are included, the rural transmission lines will cost $1,250,000. The lower Tallassee dam and station completion is another item on the 1930 budget. The company in a recent statement announced that in 1930, 69 additional rural lines would be built totaling 619 miles and affecting 40 out of the 67 counties in the state.

The Consolidated Gas, Electric Light & Power Company of Baltimore is another important system with a sizable program in prospect. This company will spend $7,500,000 during 1930.

The Pennsylvania-Ohio System, Youngstown, Ohio, will spend $3,775,000 for new construction, new equipment and other capital items in 1930, according to C. S. MacCalla, vice-president and general manager. All of the money will be spent for maintenance on an undiminished scale, requirements for this purpose being about the same in the present year, in addition to the regular wage disbursements and other operating costs. While the various improvements and extensions which are included in the 1930 construction program will be announced later, it is known that important additions to the utilization of the system's electric service for industrial purposes are assured for the coming year.

The Southern Colorado Power Company, Pueblo, Colo., has announced a construction and expansion program that will require the expenditure of approximately $1,500,000 during 1930. Increased demands for power throughout the Arkansas Valley and at Cripple Creek, where mining operations have revived, are given by company officials as the incentive for the unusual budget.

The Iowa-Nebraska Light & Power company budget for the next twelve months calls for the expenditure in excess of $3,000,000 in the territory covered, eastern and central Nebraska, western Iowa and northwestern Missouri. General manager Brooks says that distributing systems and lines are being rebuilt in approximately a third of the 300 cities and towns served, new power plants being constructed, new merchandising stores opened and new facilities installed. Rural electric line development is active in practically every part of the company territory.

Advance information received by the Oklahoma Utilities Association indicates that there will be no decrease in expenditures by public utility companies in Oklahoma during 1930 for improvement and extension of properties, according to E. F. McKay, manager of the association. "While few of the companies have yet announced their budgets, an atmosphere of optimism prevails," said Mr. McKay, "and there is every probability that expenditures for 1930 will exceed those of any previous year in the history of the state."

S. I. McElhoes, vice-president Southwestern Light & Power Company, announces that the budget of his company for the coming year allows about $1,500,000 for expansion in Oklahoma.

Stone & Webster Elects New Directors.—J. H. Manning, president of the Stone & Webster Engineering Corporation, and G. H. Clifford, president of the Stone & Webster Service Corporation, have been added to the directorate of Stone & Webster, Inc.

General Gas & Electric Plans Five-for-One Split-up.—Directors of the General Gas & Electric Corporation have approved a plan for a five-for-one split-up of the class A and class B common stock. A special meeting of the class B stockholders has been called for January 6 to consider the proposal.

Industrial Activity Under Last Year

A SOMEWHAT more than normal seasonal curtailment of general manufacturing operations in the country as a whole was witnessed during November, according to reports of electrical energy consumption in some 3,600 manufacturing plants received by the ELECTRICAL WORLD. Three influences acted to cause this curtailment—the usual seasonal decrease, hesitation due to the stock market movements and a reaction from the special rise in general manufacturing activity which began during the fall months of last year.

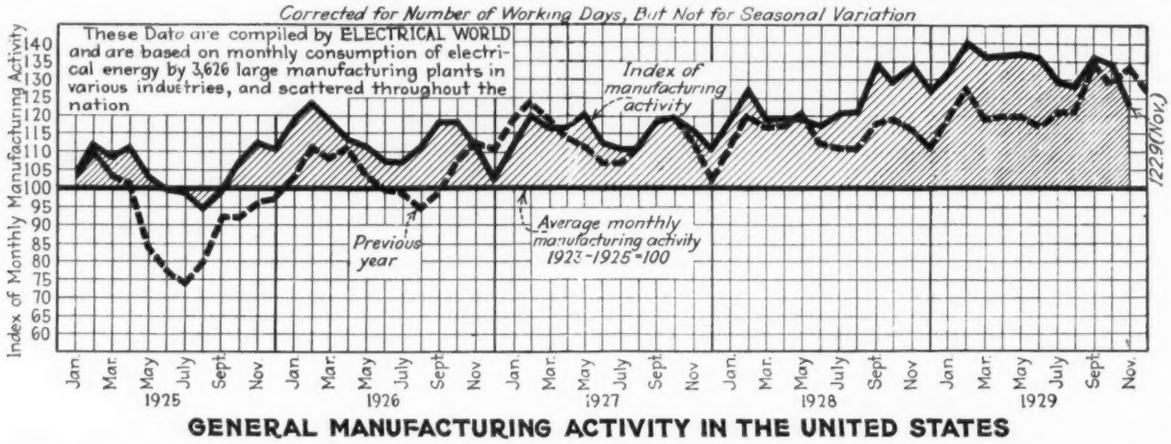
The rate of operations in general manufacturing during November, after corrections are made for number of working days, was 8.7 per cent under October and 7.8 per cent under November last year. November rate of operations was the lowest recorded since August, 1928. The average monthly activity for the first eleven months of 1929, however, was 8.1 per cent above that during the same period last year, leaving no doubt but that productive activity during 1929 as a whole will rise materially above that witnessed during 1928.

Three of the primary manufacturing groups increased their rate of activity during November as compared with October—chemical products 1.6 per cent, leather products 5 per cent and lumber products 1.8 per cent. On the other hand, eight manufacturing groups report decreased activity as compared with October—food products 2.9 per cent, rolling mills and steel plants 14.9 per cent, ferrous and non-ferrous metal-working plants 11.2 per cent, paper and pulp 5.2 per cent, rubber products 16.3 per cent, stone, clay and glass 8.2 per cent, textiles 11 per cent and automobiles, including the manufacture of parts and accessories, 27.8 per cent.

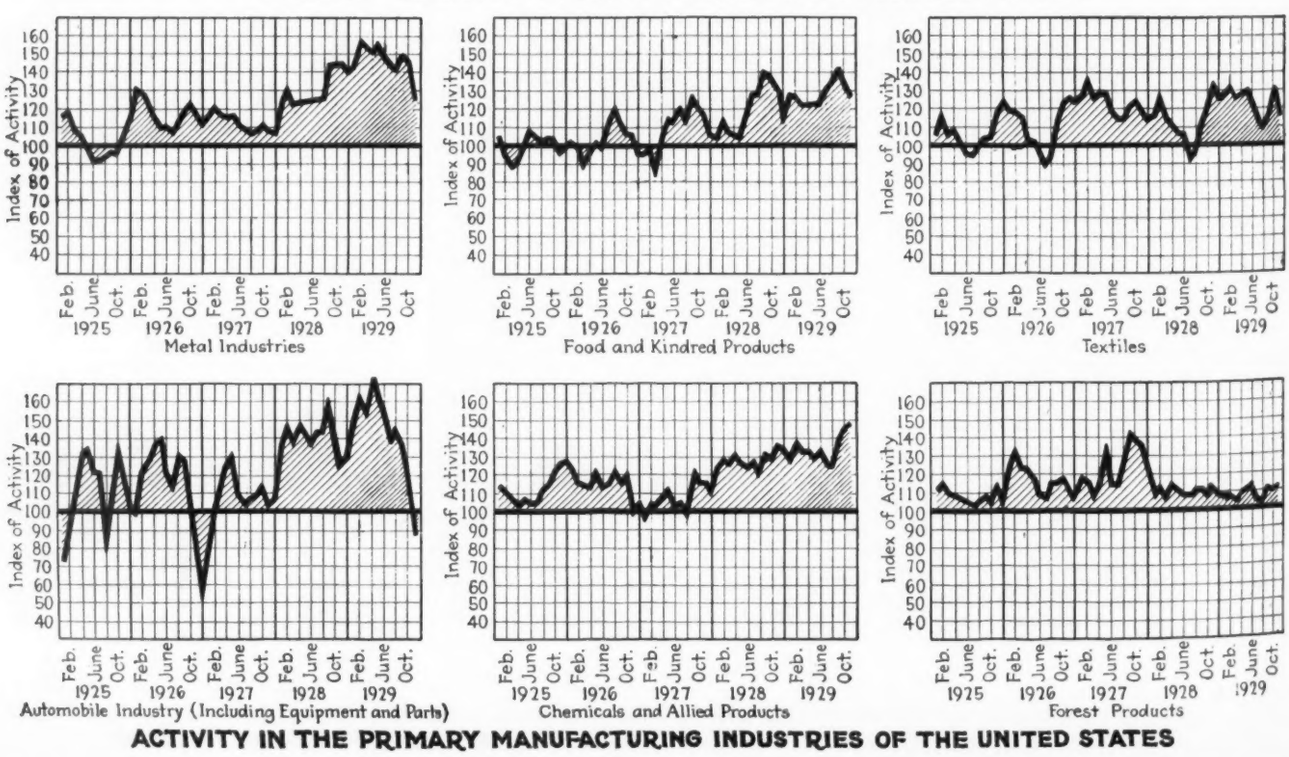
Comparing current operations with those at this time last year, two manufacturing groups reported a gain, eight groups reported a drop in activity and one group—lumber products—reported activity the same as last year. The greatest drop in comparison with November, 1928, was reported by the automobile industry with 30.4 per cent, followed by rubber products with 21.4 per cent, rolling mills and steel plants 17.2 per cent and textiles 12.8 per cent.

Every section of the country reported a rate of November operations under that of November, 1928—New England 5.3 per cent, Middle Atlantic 7.2 per cent, North Central 11.6 per cent, South 3.8 per cent and the Western States 3.3 per cent.

The automobile industry, including the manufacture of parts and accessories, not only reported the greatest drop of any manufacturing group as compared with October, 1929, and November last year—27.8 per cent and 30.4 per cent respectively—but the November rate of activity was the lowest recorded by the industry since January, 1927. It is still some 70 per cent above the low point reached during the slump witnessed at the close of 1926.


Corrected for Number of Working Days, But Not for Seasonal Variation
These Data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,626 large manufacturing plants in various industries, and scattered throughout the nation
Index of manufacturing activity
Previous year
Average monthly manufacturing activity 1923-1925=100
1229(Nov.)
Index of Monthly Manufacturing Activity
1925
1926
1927
1928
1929

GENERAL MANUFACTURING ACTIVITY IN THE UNITED STATES



ACTIVITY IN THE PRIMARY MANUFACTURING INDUSTRIES OF THE UNITED STATES

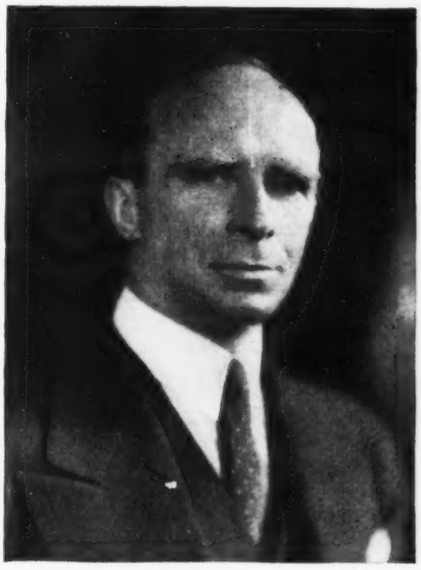
Business News and Market Conditions

Current Manufacturing Levels Will Be Maintained

Restriction in Output Should Not Exceed 3½ per Cent for First Six Months from 1929 Total, Says N.E.M.A. Head*

By Clarence L. Collens
President National Electrical Manufacturers' Association

IN AN effort to obtain a reasonably definite picture of the present state of the industry and its expectation for the first six months of 1930, a letter was addressed to 350 member companies and replies were received from 178. This letter asked for the number of productive man-hours worked in September, October and November, 1928, and for the similar period in 1929. It also asked for the productive man-hours worked in the first six months of 1929 and the anticipation for the first six months of 1930. It also asked for the condition of inventories as of December 1, 1928 and 1929. The totals indicated an increase of 14 per cent in productive man-hours for the current three months of 1929 over 1928, an anticipation of a decrease of 3½ per cent for the first six months of 1930 over 1929 and, excluding mechanical refrigeration, an almost identical inventory condition. Making approximations to cover companies not reporting or not included for one reason or another, the labor involved is in the neighborhood of 500,000,000 man-hours per year. These figures would indicate the industry to be in a thoroughly healthy condition.



Clarence L. Collens

The increase of 14 per cent for the current three months was expected and does not indicate any material shrinkage in production due to recent market conditions. It is probable that sales figures would have been a better index, but it was not believed that these could be obtained.

The anticipation is a decrease of 3½ per cent for the first six months of next year's current activity, as compared with the first six months of 1929.

A much wider response would have been secured had time permitted. It is believed that response is creditable when it is realized that but four working days were available.

The field covered by the National Electrical Manufacturers' Association is divided into 48 sections, each devoted to a characteristic line of apparatus. These sections are again grouped into divisions, of which there are a total of ten, as follows:

Appliance Division—Cognizance of fans, electric ranges, water-heating apparatus and heating appliances, such as toasters, flat-irons, radiant heaters, etc. The productive man-hours per year are of the order of 50,000,000, an increase of productive activity of 3 per cent for the current three months is shown, and an anticipated increase for 1930 over 1929 of 6 per cent. Inventories are 7 per cent less than in 1928.

Electric Refrigeration.—No real figures can be given, as insufficient report was received. The oustanding characteristic is an anticipation of an increase of 16 per cent for the first six months of 1930 over the corresponding 1929 period. Inventories are definitely higher—possible 10 per cent.

Industrial Lighting Division.—Cognizance of fixtures, reflectors, etc., for street, factory, store and building lighting. Production of the order of 5,200,000 man-hours per year. Current three months' condition plus 7 per cent. Anticipation of first six months of 1930 plus 30 per cent. Inventories 6 per cent higher.

Industrial Heating Division.—Cognizance of electric furnaces, electric welding, etc. Production of the order of 5,000,000 man-hours per year. Increase in activity for current three months over 1928 38 per cent. Anticipation first six months 1930 minus 14 per cent. Inventories—increase 30 per cent.

Insulating Material Division.—Cognizance of vulcanized fiber, mica products, laminated phenolic products and molded material. Production of the order of 35,000,000 man-hours per year. Increase in current three months over corresponding period of 1928 18 per cent. Anticipation for the first six months of 1930 a decrease of 14 per cent. Inventories 2 per cent lower than in 1928.

Overhead Trolley Line Material Division.—Production of the order of 4,200,000 man-hours per year. Increase in current three months 1929 over 1928 10 per cent. Anticipation first six months 1930—increase 14 per cent. Inventories definitely higher.

Radio Division.—The material covered includes no assembled receiving sets, but purely material entering into such sets, such as wire, sockets, condensers, etc. Production of the order of 8,000,000 man-hours per year. Increase for the current three months 20 per cent. Anticipation for the first six months of 1930 minus 32 per cent. Inventories—decrease 8 per cent.

Transmission and Primary Distribution Division.—Cognizance of high-voltage insulators, switchgear, transformers, electrical measuring instruments, etc. Production of the order of 50,000,000 man-hours per year. Increase current three months over 1928 10 per cent. Anticipation first six months 1930 10 per cent. Inventories—increase 17 per cent.

Utilization and Control Division.—Cognizance of material for power application, such as motors and generators up to 200 hp., industrial control, small circuit breakers, mining industrial locomotives, panel and distribution boards, signaling apparatus, carbon products—production of the order of 130,000,000 man-hours per year. Increase of current three months over 1928 15 per cent. Anticipation first six months 1930—decrease 13 per cent. Inventories up 6½ per cent.

Wiring Devices Division. — Cognizance of attachment plugs, fuses, knife switches, inclosed switches, lamp sockets, receptacles, snap switches, etc. Production of the order of 32,000,000 productive man-hours per year. Increase current three months 13 per cent over 1928. Anticipation first six months 1930—decrease 6 per cent. Inventories up 20 per cent.

Wiring Materials Division.—Cognizance of bare and weatherproof wire, flexible cord, heater cord, magnet wire, power cable, rubber-covered wire, etc. Production of the order of 145,000,000 man-hours per year. Increase of current three months over corresponding period 1928 13 per cent. Anticipation first six months 1930—decrease 2½ per cent. Inventories up 6 per cent.

It should be noted that the electrical manufacturing industry can, of itself, initiate little production and that in the main its activity depends upon the activity of the fields that it serves. The estimates for the first six months of 1930, therefore, are based on an estimate of conditions beyond the control of the producing companies. They represent, however, the average of the opinion of 178 companies, each in close contact with its own field.

It seems notable that the divisions dealing with goods for household application, such as heating appliances and refrigerators, definitely anticipate increases—6 per cent and 16 per cent respectively. This would indicate an opinion that the general public pur-

*Address before industry conference under auspices of United States Chamber of Commerce in Washington.

chasing power is not seriously impaired. Radio is a notable exception.

Purely industrial application indicates the opposite opinion—a decrease of 4 per cent in industrial heating—14 per cent in insulating material, 13 per cent in utilization and control being registered as the opinions of the companies involved.

The anticipated decrease of 6 per cent and 2½ per cent in wiring devices and wiring materials respectively would indicate a feeling that construction would not be as active as in the first six months of 1929. The smaller decrease in wiring materials might be explained by an anticipation of more activity in power cable and similar material used in the extension of utilities' properties.

The industry as a whole appears healthy and to anticipate a continuance of substantially normal activity during the coming six months, save in the case of radio.

The electrical industry feels that it is in a position to be of material assistance in the stimulation of industrial modernization. There are very large economies to be effected to the improvement of industrial lighting, the applications of power in mechanization, material handling and the other industrial processes. The manufacturing industries can substantially increase their prosperity by the elimination of waste through such modernization.

Good Sales in Lead—Copper Quiet

Transactions in non-ferrous metals were confined chiefly to lead, the sales of that metal being well above the average for a single week's business. Copper for domestic account was extremely quiet, though inquiry here and there showed some improvement.

New York Metal Market Prices

	Dec. 4, 1929 Cents per Pound	Dec. 11, 1929 Cents per Pound
Copper, electrolytic	18	18
Lead, Am.S.& R.price	6.25	6.25
Antimony	8½	8½
Nickel, ingot	35	35
Zinc, spots	6.35	6.35
Tin, straits	38⅞	39½
Aluminum, 99 per ct.	24.30	24.30

Market Conditions

TEMPORARY LULL in equipment buying previously reported in some sections seems to have passed. Industrial and railway electrification programs promise large orders in the Eastern district. Marine demand is heavy at the moment. Small motors and control apparatus are active in New England.

——PURCHASES OF RAILROAD EQUIPMENT have been particularly heavy in the Middle West.

——MACHINERY ORDERS, ESPECIALLY FOR TRANSFORMERS, are a feature of Pacific Coast business.

SOUTHEAST

SATISFACTORY activity in electrical lines is reported for the Southeast, though no individual orders of moment were placed last week. The Georgia Power Company and affiliated Georgia companies announced a $16,000,000 new construction budget for 1930.

One company's small power and distribution transformer orders last week aggregated $10,700, while its creosoted pine pole and pole line hardware purchases totaled $12,700. Some other central station orders were for small switches amounting to $5,500 and street lighting material amounting to $4,950. A cotton mill in South Carolina ordered motors, transformers and switchboard equipment totaling $22,000. A south Georgia town ordered construction materials and white-way materials for a 120-post system, the order amounting to approximately $35,000, in connection with plans for a municipal electric system to compete with the central station service at present supplied in the town. There is a satisfactory amount of prospective business in the territory, orders for $200,000 in industrial and substation equipment being anticipated duiring the month from Mississippi and Louisiana. A $50,000 power transformer order is expected to be let in Alabama and a number of cotton mill electrifications are anticipated immediately after the first of the year.

CONSTRUCTION PROJECTS

Virginia Public Service Company, Charlottesville, Va., plans construction of hydroelectric power plant at Blands Ford, to cost $275,000, and will extend transmission lines. Waynesboro, Va., plans extensions in ornamental lighting system. Louisville Gas & Electric Company, Louisville, Ky., plans an expansion and improvement program in generating and substation facilities, transmission lines, etc., to cost $4,900,000. Standard Oil Company of Kentucky, Louisville, Ky., plans oil-storage and distributing plant at Savannah, Ga., to cost $100,000. Kentucky-Tennessee Light & Power Company, Bowling Green, Ky., is said to be planning construction of transmission line from Hopkinsville to Clarksville, to operate at 33,000 volts. Nashville Interurban Company, Nashville, Tenn., plans power plant at Franklin, Tenn., to cost about $100,000. Brunswick, Ga., contemplates installation of floodlighting system and beacon lamps in connection with municipal airport to cost $250,000.

MIDDLE WEST

GENERAL business in the Middle West section shows improvement. Steel operations are lower; automotive production has decreased, although both are expected to resume at a higher rate after the first of the year.

RAILROAD equipment purchasing has been particularly gratifying this year and announced plans indicate huge expenditures next year. Some slight encouragement is obtained from building activities, although the employment situation is particularly acute.

THE ELECTRICAL industry is continuing at the same pace, with the utility companies working at top speed on circuit revision and line extension work.

Cable requirements contemplated for next year, in many instances, will greatly exceed those of previous years. Some of the interesting orders placed this week include five boiler feed and two excess pressure regulators, chlorine treating equipment complete for two boilers, three 1,200-amp. and three 600-amp. single-pole, single-throw, 88-kv., frame-mounted, solenoid-operated oil circuit breakers and 27 450-amp., 225-volt current-limiting reactors.

CONSTRUCTION PROJECTS

Board of County Commissioners, Waukesha, Wis., has authorized a power plant at the county asylum to cost $38,000. Madison, Wis., plans ornamental lighting system. Limousine Body Company, Kalamazoo, Mich., plans an expansion and improvement program to cost more than $100,000. American Twist Drill & Tool Company, Detroit, Mich., has plans for an addition to cost $85,000. Bopp Steel Corporation, Detroit, Mich., is completing plans for a mill to cost $1,000,000. Allegan, Mich., has completed plans for a municipal hydroelectric power plant to cost $400,000. Dow Chemical Company, Midland, Mich., will build an addition to power plant to more than double present capacity, reported to cost $100,000. Kraft-Phenix Cheese Company, Chicago, Ill., plans plant at West Jefferson, N. C., to cost $100,000. Chicago, North Shore & Milwaukee Railroad, Chicago, Ill., plans car and locomotive shops at Waukegan, Ill., to cost $1,000,000. Commonwealth Edison Company, Chicago, Ill., will build substations on Wabash Avenue, Narragansett and West Congress Streets, to cost more than $175,000. Dallas Brass & Copper Company, Chicago, Ill., plans extensions in plant to cost about $700,000. Midwest Canning Corporation, DeKalb, Ill., plans plant at Genoa, Ill., to cost $300,000. Monarch Tractor Corporation, Springfield, Ill., has approved plans for

an addition to cost $400,000. Sherwin-Williams Company, Cleveland, Ohio, will carry out an expansion and improvement program at paint and varnish plants to cost $400,000. Cleveland Union Terminals Company, Cleveland, Ohio, will build a machine shop to cost $80,000. Brownell Company, Dayton, Ohio, plans additions and improvements in boiler and stoker manufacturing plant to cost $200,000. Fyr-Fyter Company, Dayton, Ohio, plans addition to fire-extinguisher manufacturing plant to cost about $90,000. Pennsylvania-Ohio Power & Light Company, Youngstown, Ohio, plans an expansion and improvement program at power plants, substations, transmission and distributing lines to cost $3,750,000. Board of County Commissioners, Cincinnati, Ohio, plans addition to power plant, mechanical laundry, service and garage building, reported to cost more than $100,000. Standard Oil Company of Ohio, Cleveland, Ohio, plans extensions and improvements in oil refineries, storage and distributing plants to cost more than $1,000,000.

Pacific Coast

LONG-DEFERRED rain has begun and there are a few inches of snow at the summit in the Sierras as compared with a normal of 5 ft.

CHRISTMAS shopping is keener than for several seasons and with definite reaction toward price.

CHEAPER styles of appliances and radios are in demand.

Machinery orders, especially for transformers, have featured December, the outstanding order covering two Pelton impulse wheels for the Tiger Creek development, each 36,000 hp., installed under a 1,221-ft. head, complete with auxiliary equipment, and one vertical reaction Pelton turbine for the Salt Springs development, 13,500 hp., 244-ft. head. These are Pacific Gas & Electric projects. Westinghouse reports stock orders from the Southern California Edison Company aggregating $315,000 worth of oil-insulated transformers, also four oil circuit breakers, sizes 600 and 1,200 amp., 73,000 volts for a Seattle installation and $20,000 worth of 1,500-kva. transformers for installation in the new Standard Oil plant at El Segundo. General Electric Company reports 566,000-volt potential transformers for the Bay Shore installation, also four 275-hp. mechanical drive turbines for the El Segundo oil plant. Distributing transformers and medium-sized industrial motors are selling well. Other power company business includes one carload each of porcelain and glass high-tension insulators, two carloads of 40-ft. poles and one carload each of weatherproof and bare copper wire. Government business includes replacing poles and pole line hardware for forts around San Francisco harbor, $250,000 worth of construction for the Yountville Veterans' Home, a power plant near Crescent City and a $2,000,000 marine hospital in the San Francisco government reservation. Street-lighting business has markedly decreased. Building construction has increased, especially in hotels, theaters and schools.

Contracts involving an expenditure in excess of $200,000 providing for a $70,000 waterwheel, a $90,000 generator and $55,000 in transformers have been placed by the British Columbia Electric Railway Company in connection with the fourth unit of the Jordan River hydro-electric development near Victoria, B. C. Contracts, including penstocks, costing approximately $400,000 are already let. Portland Electric Power Company plans the expenditure of $4,300,000 during 1930, the program including a 46,000-hp. steam turbine at East Lincoln Street steam plant and a 40,000-hp. hydro-electric turbine at Oak Grove plant on Clackamas River. Seattle City Council passed an ordinance providing for the purchase of the second generating unit of 60,000 kw. capacity for Diablo, specifications for which have been written. The city of Seattle is taking bids for two three-pole, 7,500-volt, 1,200-amp. oil circuit breakers and the Puget Sound Power & Light Company bought a number of transformers, ranging from 3 to 15 kw. for the northern division.

CONSTRUCTION PROJECTS

Pacific Gas & Electric Company, San Francisco, Calif., plans power plant at Modesto, Calif., to cost about $200,000. Los Angeles, Pacific Grove, South San Francisco, Gustine, San Leandro and Berkeley, Calif., plan ornamental lighting systems. Lodi, Calif., is considering municipal power plant and transmission system to cost $450,000. Hood River Canning Company, Hood River, Ore., plans plant at Portland, Ore., to cost $100,000. Kalispell, Mont., and Pomeroy, Wash., plan ornamental lighting system. Progress Gold Mining Company, Murray, Idaho, plans milling plant in 1930 to cost more than $200,000. Alta Mining Company, Telluride, Colo., plans rebuilding of portion of ore mill about 9 miles from city, recently destroyed by fire with loss of about $300,000. Oliver Power Company, Paonia, Colo., plans steam-operated electric power plant reported to cost in excess of $150,000, with transmission lines. Pueblo, Colo., has authorized installation of an ornamental lighting system.

Southwest

THERE has been a steady demand for distribution transformers, meters and stock sizes of motors. Several good sized shipments of poles, line material and outdoor switching equipment are reported.

CENTRAL STATIONS over this district are still buying in good volume.

The only contracts noted as worthy of mention are a 2,500-kw. turbo-generator unit for a municipal plant in Oklahoma, the cost with condenser to be $70,000, and substation equipment for an industrial concern in northern Arkansas to cost $3,000.

CONSTRUCTION PROJECTS

St. Louis-San Francisco Railroad Company, St. Louis, Mo., plans shops and yard buildings at Springfield, Mo., in connection with terminal expansion at that place to cost $1,800,000. United States Cold Storage Company, Kansas City, Mo., plans addition to cold storage and refrigerating plant to cost about $1,000,000. Great Western Cold Storage Warehouse Company, Oklahoma City, Okla., plans cold storage and refrigerating plant to cost $300,000. Arkansas Power & Light Company, Pine Bluff, Ark., will install an ornamental lighting system at Harrison, Ark. Missouri & North Arkansas Railroad Company, Harrison, Ark., plans locomotive repair shops at Kensett, Ark., to cost $80,000. Terrell State Hospital, Terrell, Tex., plans extensions and improvements in power plant to cost $50,000. Whitesboro, Tex., contemplates ornamental lighting system in business district. Alexandria, La., plans ornamental lighting system.

Eastern

BUSINESS is resuming a more normal status in the electrical equipment market in the Eastern district.

CENTRAL STATION buying continues on a basis of immediate needs, but industrial account shows up more actively and a number of basic lines of manufacture give promise of early sizable purchases.

RAILROAD BUDGETS for 1930, now being announced, indicate that heavy transactions are soon to mature for equipment for electrification programs, and there is pronounced optimism in this line.

Marine account is a feature of current sales. The General Electric Company has secured a contract for the complete electrical equipment for two Diesel-electric tankers to be constructed by the Bethlehem Shipbuilding Corporation, Quincy, Mass., for the Lake Tankers Corporation, a subsidiary of the Shell Oil Company. Also, similar equipment for three Diesel-electric boats for the government, one of which will be built by the Charleston Drydock & Machinery Company, Charleston, S. C., and the two others by the Charles Ward Engineering Works, Charleston, W. Va. Street railway account has been advancing; the Westinghouse Electric & Manufacturing Company has secured contracts totaling about $3,500,000 for street car motors and controls during the past few weeks, and there is further business in sight in this direction.

A manufacturer of control equipment says that heavy business is developing from the steel mills and that expansion programs in this line of industry, to be completed next spring, will show active commitments for a number of weeks to come. A New York maker of heavy and light equipment reports improvement in the local market, particularly in industrial account.

Industrial motor sales are advancing, with fractional-horsepower units sharing in the call. A producer of washing machines in New York has contracted for a quantity of motors to cost $45,000.

The General Electric Company will

furnish substation apparatus for the Minidoka project of the Bureau of Reclamation in Idaho, including transformers, oil circuit breakers, lightning arresters and accessory equipment, totaling $56,661. A power company in Maryland has placed an order for oil switches and auxiliary apparatus with a Pennsylvania maker. A manufacturer of wire and cable reports satisfactory business both from utility companies and industrials; radio account has slackened materially in recent weeks, but gives indications of coming back soon. A maker of line equipment says that business is fair, with the bulk of orders small, primarily for immediate requirements only; inquiries are growing stronger for commitments to be placed after the first of the year. A producer of fuses and kindred specialties states that gross sales are well distributed in different lines, with total volume fair.

CONSTRUCTION PROJECTS

Chase Bag Company, New York, plans plant at Goshen, Ind., to cost $100,000. Westchester Lighting Company, Mount Vernon, N. Y., has arranged an expansion and improvement program for 1930, including transmission line and substation construction, to cost $8,000,000; company will begin superstructure for power substation at Mount Kisco, to cost $100,000. Fein Tin Can Company, New York, will establish a plant in Brooklyn to cost more than $150,000. Stone Ice Cream Company, Buffalo, N. Y., plans plant to cost $400,000. Rubel Coal & Ice Corporation, Brooklyn, N. Y., will build an ice and ice cream manufacturing plant to cost $400,000. New York & Ontario Power Company, Ogdensburg, N. Y., plans hydro-electric power plant at Waddington, N. Y., to cost about $500,000. Idealite Lamp Shade Manufacturing Company, New York, will establish a plant at Jersey City, N. J., to cost about $100,000. Department of Public Affairs, Newark, N. J., will receive bids until December 19 for storage batteries, etc. Public Service Electric & Gas Company, Newark, N. J., contemplates the installation of a street-lighting system at Elizabeth, N. J., replacing present gas-lighting system. Philadelphia Electric Company, Philadelphia, Pa., plans equipment storage, repair and distributing plant at West Conshohocken, Pa., to cost $60,000. Standard Oil Company of Pennsylvania, Inc., Philadelphia, Pa., plans immediate call for bids for refining, storage and distributing plant to cost more than $250,000. Tasty Baking Company, Philadelphia, Pa., has filed plans for plant to cost more than $400,000. Sun Oil Company, Philadelphia, Pa., contemplates an expansion and improvement program at plants at Linwood and Marcus Hook, reported to cost more than $3,000,000. Davison Chemical Company, Baltimore, Md., contemplates a plant addition to cost $225,000. Loyola College, Baltimore, Md., plans an engineering building to cost $150,000. Water Department, Baltimore, Md., will soon take bids for an electric-operated pumping plant to cost over $500,000. Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids until December 20 for 750 storage batteries for the Philadelphia, Pa., Navy Yard (Schedule 2401). General Purchasing Officer, Panama Canal, Washington, D. C., will receive bids until December 26 for switchboards, rectifiers, flashlight batteries and other electrical and mechanical equipment (Panama Schedule 2512).

NEW ENGLAND

BUYING in this district during the past week was irregular. Small power equipment, both motors and control apparatus, was in good demand and sales compared with last year for this month so far show an encouraging increase.

SCHEDULED materials are selling well, though a slight easing off is reported due to seasonal conditions. Manufacturers of electric heating furnaces report active interest on the part of machine tool and metal-working industries; negotiations for heavy industrial machinery are marking time.

Interior electric lighting projects are gaining, as are sales of institutional type reflectors.

Outside of the electric machinery field buying of electrical appliances and devices is gaining. Merchandising is showing encouraging gains over last year; radio sets and equipment are attracting interest and reports indicate an increase in volume over that for last year. A $10,000,000 newsprint paper mill with a daily capacity of 270 tons is planned by the Maine Seaboard Paper Company at Bucksport, Me.

CONSTRUCTION NEWS

Boston & Maine Railroad Company, Boston, Mass., has arranged a fund of $100,000, for purchase of tools and equipment for engine house and shops at Somerville, Mass. Heil Company, Milwaukee, Wis., has filed plans for motor truck body factory branch and distributing plant at Brighton, Mass., to cost about $50,000. American Bosch Magneto Corporation, Springfield, Mass., has filed plans for an addition to cost about $50,000. Boston & Albany Railroad Company, Boston, Mass., has filed plans for a power plant at Allston, to cost $80,000.

Activities of the Trade

New Series of Decorative Lamps Announced

The Edison and National Lamp Works of the General Electric Company have announced that development work has been completed on the application of the inside colored process to the 10-watt, 110-, 115-, 120-volt, S-11 intermediate screw-base Mazda lamps. Three lamps which were formerly supplied only in the outside colors are now available in the inside colored finish in the full line of standard colors, including red, yellow, green, blue, amber-orange, flametint and white.

The inside colored finish, it is claimed, represents a distinct advantage over the outside coating in the lamp, particularly in its application to outdoor signs and decorative lighting.

Westinghouse Raises Dividend

Westinghouse Electric & Manufacturing Company has increased its annual dividend on the common and preferred stocks from $4 to $5 and declared the first quarterly dividend at the new rate payable on the preferred stock on January 15, and on the common stock on January 31, both to stockholders of record on December 31.

G. E. Supply Contest Nets $872,025 New Business

The total net gain of the "Golden Eagle Sales Conquest," a sales contest conducted by the new General Electric Supply Corporation, Bridgeport, Conn., was $872,025 worth of Edison "Mazda" lamp contracts. The conquest was designed to secure new lamp business during the four summer months of June, July, August and September. Two hundred and fifty-five men from the 34 supply houses competed for the $1,200 in cash prizes and the testimonial banquet for men selected given at Detroit.

New Equipment Company Organized

Hill Equipment Engineering Company has been organized with offices in St. Louis by Lockwood Hill, for the past ten years a member of the Blackman Hill Company. The new organization will have the exclusive sale of the products of the Lincoln Electric Company and the Baker Industrial Truck Company in the St. Louis metropolitan district and the eastern Missouri and southern Illinois territories. The new company will carry a complete stock of "Linc-Weld" motors and "Stable-Arc" welders, welding supplies, accessories and parts. Mr. Hill is a pioneer in the arc welding field.

OHIO BRASS COMPANY, Mansfield, Ohio, announces that its Boston office, in charge of Harvey H. Hoxie, has been removed from its former location in the Little Building to Room 1001, Statler Building, 20 Providence Street.

DELTA-STAR ELECTRIC COMPANY, Chicago, Ill., has named Paul H. Butler, who for five years has been engaged in sales work out of the New York office, manager of the New York office. From 1921 to 1924 Mr. Butler was a member of the firm of Harris & Butler, representative of several electrical manufacturers at Philadelphia. During the preceding six years he was manager of the New York office of the Pittsburgh Transformer Company.

New Equipment Available

High-Voltage Corrugated Primary Brackets

A new high-voltage primary bracket which is corrugated to increase the creepage voltage value and which has heads of wet process porcelain is announced by the Line Material Company, South Milwaukee, Wis.

One of these new brackets is rated 5,000 volts and is used for supporting a duplex cable on short runs. It is provided with a No. 22 brass screw securely leaded into the porcelain. This bracket is also used for mounting on the side of the crossarm, for dropping leads down to transformers or lighting units. It has a dry flashover rating of 36,000 volts and a wet flashover of 17,000 volts when placed on top of the crossarm. When placed on the side of the crossarm the wet flashover voltage is 22,000.

Another type of bracket is rated 6,600 volts. Here a large pin is used instead of the No. 22 brass screw. It is usually used on the pole to take care of long drops, transformer buses and where greater clearance to ground is desirable. The dry flashover rating is 52,000 volts and the wet flashover is 23,000 volts when mounted on top of the crossarm. The wet flashover is 27,000 volts when mounted on the side of the crossarm.

The bracket has been developed particularly for duplex cable, which explains the large opening in the insulator.

Ultra-Sensitive Thermocouple Instruments

For high-frequency measurements in various kinds of radio development work the Jewell Electrical Instrument Company, 1650 Walnut Street, Chicago, has developed milliammeters using special internal vacuum thermocouples in standard ranges as low as 10.

These instruments are furnished in flush type cases of molded bakelite. They are provided with multiple layer coils and high quality springs, adjusted to full scale deflections of 200, 300 and 500 microamperes, respectively, for ranges carried in stock. These low-range, high-frequency instruments are recommended for wavemeter work, as well as for the determination of many circuit constants using radio-frequency current. Coil resistance, decrement, parasitic oscillations and many other determinations may be made, using these sensitive instruments without the necessity of using laboratory type galvanometers with separate thermocouples.

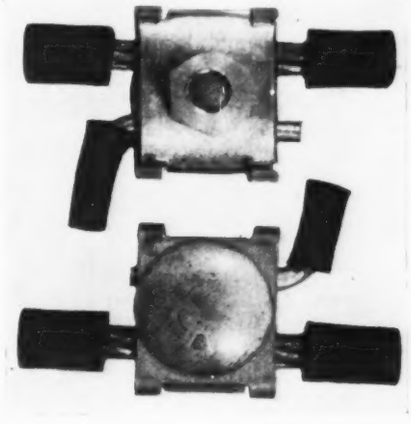
Portable Engine Generator Light Plant

To meet a growing demand on the part of contractors for dependable sources of power to supply illumination for night work, Fairbanks Morse & Company developed a compact self-contained light plant that should fit adequately into this field. The plant comes in two sizes, 750 and 1,500 watts. The engine is a Fairbanks-Morse self-oiling "Z" unit with high-tension magneto ignition. Generator is a ball-bearing machine mounted directly above the engine and driven by "Z" type belt. Control devices are mounted in a completely inclosed box mounted on the main frame and consist of push-button start and stop and devices for high and low rates of battery charge. This plant is offered in a variety of storage battery combinations for 32 or 115 volts. The unit is furnished also without the battery for direct utilization of the generated energy.

Tap and Jumper Connections

A three-piece clamp type connector for tap and jumper connections for primary and secondary lines or distribution systems is announced by the Delta Star Electric Company, Chicago.

This connector is of the single-bolt type and avoids soldering operations

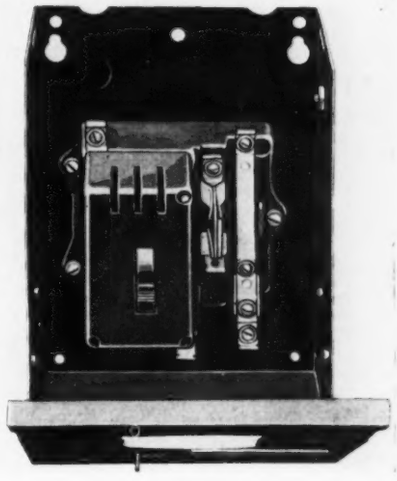


which tend to anneal hard-drawn copper wire. The edges of both the top and bottom clamping pieces are rounded and will not cut the conductor.

One size of clamp takes any combination of through run and tap from No. 1 stranded to No. 6 solid. It is designed to carry 150 amp.

Service Breaker to Halt Plug Fuse Troubles

A new meter service breaker which it is claimed will banish the troubles presented by plug fuses is announced by the Square D Company, Detroit, Mich. The box of the service breaker is of the usual size. Arrangement is made for ordinary meter trims and for banking troughs. There is a special bolt for locking the meter trims in place. Since there is no need to have access to the



circuit-breaking mechanism it is sealed inside an insulating cover to protect it against tampering and to keep out dirt when it is being installed.

According to the manufacturer, absence of fuses in the Square D meter service breaker does away with the problems of sealed main fuses, accessible fuses, interlocking doors and all undesirable features of service switches. Front manual operation enables the service breaker to be banked more closely and recessed and its quick make and break banishes contact burning and variable action, it is claimed by the manufacturer. Its front operating handle is fully insulated so that the operator cannot receive a shock through it. According to the producer it is better than fuses because of its longer time element. It withstands temporary overloads but opens the line before any damage can be done and is fast enough to protect rubber-covered wire under all overload conditions.

Projector to Test Gears for Watt-Hour Meters

In connection with the accuracy required in making every piece used in the watt-hour meters, Westinghouse Electric & Manufacturing Company has devised contour projectors to measure the accuracy of the gears. The apparatus magnifies these small gears 100 times and enables the operator to compare the magnified image with the perfect design on the ground glass before him.

Electrical Patents

Announced by U. S. Patent Office

(Issued November 12, 1929)

1,735,271. DIATHERMY KNIFE; S. H. Groff, Long Beach, Calif. App. filed March 14, 1928.

1,735,286. PROCESS OF COATING METALLIC ALUMINUM OR ALUMINUM ALLOYS WITH ALUMINUM OXIDE SKIN; T. Kujirai, Nakano-Machi, Toyotama-Gori, and S. Ueki, Oji-Machi, Kitatoshima-Gori, Tokyo, Japan. App. filed Dec. 2, 1924.

1,735,301. CABLE-CONVEYING MEANS; W. Short, Webb City, Mo. App. filed Dec. 3, 1926.

1,735,305. PULL-CHAIN LAMP SOCKET; W. C. Tregoning, Wauwatosa, Wis. App. filed July 14, 1928.

1,735,316. ELECTRICAL CONNECTOR; J. W. Hamilton, Atlanta, Ga. App. filed June 21, 1927.

1,735,331. OUTLET BOX; J. J. Merrill, Ipswich, Mass. App. filed Aug. 18, 1921.

1,735,357. CONTROL MEANS FOR MULTIPLE-WAY ELECTRIC CIRCUIT DEVICES; R. E. Ollerenshaw, London, England. App. filed Nov. 15, 1926.

1,735,363. MASTER CONTROL; C. J. Victoreen, Cleveland Heights, O. App. filed June 3, 1926.

1,735,364. VARIABLE VOLTAGE SYSTEM OF SPEED CONTROL FOR MOTORS; C. P. Walker, Los Angeles, Calif. App. filed May 24, 1927.

1,735,381. CONDENSER; T. C. Deutschmann, Boston, Mass. App. filed June 12, 1926.

1,735,403. SIGNALLING DEVICE; J. L. MacCarthy, Brooklyn, N. Y. App. filed Feb. 3, 1926.

1,735,416. RADIO CONDENSER; J. J. Aurynger, Brooklyn, N. Y. App. filed Sept. 8, 1922.

1,735,419. ELECTRIC FURNACE; F. W. Brooke, Pittsburgh, Pa. App. filed June 2, 1928.

1,735,435. VARIABLE CONDENSER; H. H. Ide, La Grange, Ill. App. filed Jan. 21, 1926.

1,735,485. SELECTIVE PYROMETER READING SWITCH; E. Williams, Pelham, N. Y. App. filed Jan. 12, 1928.

1,735,494. NEUTRALIZER BAR; W. H. Chapman, Portland, Me. App. filed Feb. 12, 1925.

1,735,509. PROCESS OF FORMING AN ELECTRICALLY INSULATING AND ANTICORROSIVE OXIDE COATING ON ALUMINUM MATERIAL; S. Setoh, Tokyo, and S. Ueki, Deceased Late of Oaza, Japan. App. filed Oct. 22, 1926.

1,735,530. SYSTEM FOR PROTECTING PETROLEUM TANKS AND TANK FARMS AGAINST LIGHTNING AND ELECTRICAL SPARKS; W. Dodd, Des Moines, Ia. App. filed May 31, 1927.

1,735,532. VARIABLE CONDENSER; W. Dubilier, New York City, N. Y. App. filed Sept. 3, 1924.

1,735,533. CONTACT FOR ELECTRICAL HEATER PLUGS; J. P. Eastman, Manitowoc, Wis. App. filed Mar. 14, 1927.

1,735,540. TIME SWITCH; F. Lux, Waterbury, Conn. App. filed April 19, 1928.

1,735,554. WATER HEATING APPARATUS; J. A. Thatcher, San Francisco, Calif. App. filed Mar. 14, 1927.

1,735,556. HANDLE AND SWITCH; E. W. Wiehle, Chicago, Ill. App. filed Feb. 1, 1928.

1,735,560. INSULATOR FOR WITHSTANDING FOG CONDITIONS; A. O. Austin, Barberton, O. App. filed Aug. 11, 1924.

1,735,561. FITTING FOR INSULATORS; A. O. Austin, Barberton, O. App. filed July 2, 1926.

1,735,562. SIGNAL DEVICE; I. Caplan, Des Moines, Ia. App. filed May 21, 1928.

1,735,579. SHORT-CIRCUITING DEVICE FOR MOTOR COMMUTATORS; E. P. Larsh, Dayton, O. App. filed Jan. 17, 1921.

1,735,588. RETARDED CIRCUIT BREAKER; H. R. Stewart, Los Angeles, Calif. App. filed Aug. 29, 1925.

1,735,593. IGNITION TESTER GAUGE; G. Zittmann, Yonkers, N. Y. App. filed Aug. 23, 1927.

1,735,614. HEAT CONTROLLED ELECTRIC SWITCH; J. W. Layman, Marionville, Mo. App. filed April 2, 1927.

1,735,623. DISTANCE-MEASURING APPARATUS; G. Walker, Newton Center, Mass. App. filed Dec. 15, 1926.

1,735,629. HYDROCARBON BURNER; M. H. Braden, Providence, R. I. App. filed Feb. 14, 1929.

1,735,656. INSULATING COVER FOR ELECTRIC-LAMP SOCKETS; P. A. Rossi, Campbell, O. App. filed May 31, 1928.

1,735,663. CONDUIT FITTING; M. L. Ansel, Chicago, Ill. App. filed Mar. 9, 1927.

1,735,667. DRUMLESS SEARCHLIGHT; P. R. Bassett, Brooklyn, N. Y. App. filed Aug. 30, 1918.

1,735,672. ELECTRIC FUSE; H. T. Bussmann, St. Louis, Mo. App. filed March 20, 1922.

1,735,679. THERAPEUTIC LAMP; N. E. Goodrich, Battle Creek, Mich. App. filed Feb. 6, 1929.

1,735,690. SYSTEM OF DISTRIBUTION; C. R. Martin, Wauwatosa, and H. V. Nye, West Allis, Wis. App. filed Nov. 12, 1925.

1,735,706. CONTROLLER FOR ELECTRIC INDICATORS; F. W. Wood, Montclair, N. J. App. filed April 20, 1923.

1,735,731. ATTACHMENT PLUG FOR ELECTRIC HEATING DEVICES; R. H. Cunningham, Jackson, Mich. App. filed July 15, 1927.

1,735,762. TIMING MECHANISM; H. Huthmacher, Irvington, N. J. App. filed Dec. 30, 1927.

1,735,782. BATTERY CABLE CLAMP; O. Oldham, Bedford, Ind. App. filed May 21, 1928.

1,735,791. STATION INDICATOR; G. Puskas, Woodridge, Manitoba, Can. App. filed June 16, 1928.

1,735,820. STABILIZER; N. C. Ward, Chicago, Ill. App. filed Feb. 20, 1928.

1,735,829. MEANS AND METHOD FOR CONTROLLING SURFACE RESISTANCE OF INSULATORS; A. O. Austin, Barberton, O. App. filed Oct. 20, 1921.

1,735,831. ELECTRIC HEATER AND METHOD OF MAKING THE SAME; E. N. Lightfoot, Wauwatosa, Wis. App. filed May 7, 1925.

1,735,834. ELECTRIC GAS LIGHTING DEVICE; J. W. Mayo, Wilkinsburg, Pa. App. filed Mar. 13, 1924.

(Issued November 19, 1929)

17,493 (reissue). SNAP SWITCH; S. A. Meyers, San Francisco, Calif. App. filed July 15, 1926.

1,735,845. AUTOMATIC SWITCH; E. C. Blem, Hellerup, near Copenhagen, Denmark. App. filed Dec. 20, 1926.

1,735,856. ELECTRICAL PLUG; N. C. Greene, New York, N. Y. App. filed May 19, 1926.

1,735,873. SOUND REGENERATING DEVICE; W. D. Pack and J. M. S. King, Salt Lake City, Utah. App. filed July 29, 1926.

1,735,874. VIBRATORY UNIT; W. D. Pack, Salt Lake City, Utah. App. filed Sept. 30, 1927.

1,735,878. DEVICE FOR MEASURING THE CURRENT DENSITIES OF GALVANIC BATHS; W. A. F. Pfanhauser, Leipzig, Germany. App. filed May 7, 1928.

1,735,889. VARIABLE CONDENSER; J. T. B. Blough, East Pittsburgh, and E. E. Chronister, Turtle Creek, Pa. App. filed March 5, 1927.

1,735,895. VEHICLE SIGNAL; L. Del Pilar, Seattle, Wash. App. filed Feb. 23, 1927.

1,735,907. FIRE ALARM; H. T. Mitchell, Kansas City, Mo. App. filed Dec. 19, 1926.

1,735,919. AMMETER; J. E. Eshbaugh, Flint, Mich. App. filed Sept. 22, 1927.

1,735,934. ADVERTISING DEVICE; J. E. O'Brien, Brooklyn, and T. F. O'Brien, Richmond Hill, N. Y. App. filed June 16, 1927.

1,735,936. PROCESS IN THE MANUFACTURE OF ELECTRODES; M. O. Sem, Buffalo, N. Y., and C. Wilhelm Solderberg, Oslo, Norway. App. filed Aug. 31, 1927.

1,735,947. HIGH AND MEDIUM INTENSITY SEARCHLIGHT; P. R. Bassett, Brooklyn, N. Y. App. filed Nov. 20, 1918.

1,735,981. PLUG-IN COUPLING FOR ELECTRIC CONDUCTORS; K. Schnell, Ulm-on-the-Donau, Germany. App. filed July 6, 1928.

1,735,997. LIGHTING FIXTURE; L. C. Doane, Meriden, Conn. App. filed Feb. 25, 1927.

1,736,004. IGNITION-TESTING DEVICE; W. K. Hack, Santa Cruz, Cal. App. filed Oct. 5, 1925.

1,736,020. CABLE CONNECTER; G. C. Thomas, Jr., Elizabeth, N. J. App. filed July 26, 1926.

1,736,027. THERMOSTATIC-CIRCUIT CONTROLLER; E. T. Williams, Brooklyn, N. Y. App. filed March 10, 1923.

1,736,028. ELECTRIC PANEL OR DISTRIBUTION BOARD; F. O. Winklehaus, Woodhaven, N. Y. App. filed Oct. 21, 1922.

1,736,043. INSULATOR; W. D. Kyle, Milwaukee, Wis. App. filed Oct. 4, 1923.

1,736,044. SCREW INSULATOR; W. D. Kyle, Milwaukee, Wis. App. filed Nov. 21, 1924.

1,736,069. VEHICLE TRAFFIC SIGNAL SWITCH; W. W. Bugh, North Tonawanda, N. Y. App. filed April 5, 1927.

1,736,090. DEVICE FOR INDICATING APPARENT ENERGY CONSUMPTION; R. Pudelko, Zug, Switzerland. App. filed Oct. 22, 1924.

New Trade Literature

FLAMMABLE VAPOR INDICATOR.—Mine Safety Appliances Company, Pittsburgh, has issued bulletin No. 113, descriptive of the F-M continuous flammable vapor indicator. The bulletin describes in detail the principles of operation of this instrument, designed to continuously indicate the degree of flammability, or proximity to explosive conditions, of combustible gases or vapors liberated in processes such as lacquering, japanning, etc.

INSULATORS.—A new circular entitled "Westinghouse Apparatus Insulators" has been recently issued by the Westinghouse Electric & Manufacturing Company. It describes outdoor apparatus insulators, which have a broad application for assembling switchgear apparatus, such as bus supports, disconnecting switches, etc. The design is sometimes called the pillar, switch or bus type insulator. This circular gives information and test data on the new complete line of outdoor apparatus insulators.

ELECTRIC AIR HEATERS.—Bulletin C-108A, discussing various strip and space heaters, has been issued by Edwin L. Wiegand Company, Pittsburgh, Pa. This bulletin shows actual installation pictures of where these air heaters can easily be installed in crane cabs, substations, protecting sprinkler values, keeping pumps working and in isolated offices and shops.

ROLLER CHAINS.—Link-Belt Company, Indianapolis, Ind., has just published a new roller chain data book No. 1257 which is a comprehensive manual for properly selecting and applying chain. This 96-page book illustrates the construction of the chains and wheels and presents many pages showing practical applications of Link-Belt roller chain on light and heavy duty industrial drives and on all types of machinery, tractors, trucks, farm implements, etc. The data are clearly compiled to enable one to select the proper chain and wheels to suit individual conditions, and to figure costs. Also an additional feature of value is a presentation of lists of wheels up to 81 teeth.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is sought in Malmo, Sweden (No. 42,514), of storage battery separators.

Purchase is sought in Toronto, Canada (No. 42,617), of electrical fixtures and appliances.

Agency is south in Chefoo, China (No. 42,517), for flashlights and batteries.

Purchase is sought in Toronto, Canada (No. 42,617), of electrical frankfurter grills for highway stands.

Agency is sought in Karlsruhe, Germany (No. 42,523), for household electrical appliances.

Agency is sought in Hamburg, Germany (No. 42,596), for small household electrical appliances.

Agency is sought in Tela, Honduras (No. 42,548), for household electrical appliances, such as percolators, irons, hot plates, and toasters.

Agency is sought in São Paulo, Brazil (No. 42,518), for household electrical appliances and floor-surfacing machines.

Agency is sought in Berlin, Germany (No. 42,522), for fractional-horsepower electric motors.

Agency is sought in Vienna, Austria (No. 42,516), for electric motors and controls.

Agency is sought in Nantes, France (Nos. 42,559, 42,560 and 42,561), for electric paint sprayers.

Agency is sought in Montpelier, France (No. 42,520), for electric refrigerators for commercial and household use.

Agency is sought in Frankfort, Germany (No. 42,594), for permanent-wave machines, vibrators, etc.

Agency is sought in Melbourne, Australia (No. 42,513), for resistance and asbestos insulated wire.